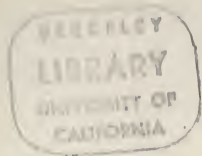


[Livingston and Clayney, San Francisco]

Livermore-Pleasanton BART Extension Study Preliminary Alternatives



LIVERMORE-PLEASANTON BART EXTENSION STUDY

PRELIMINARY ALTERNATIVES

March 14, 1973

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Prepared for LIVERMORE-PLEASANTON BART EXTENSION BOARD

LIVINGSTON AND BLAYNEY, CITY AND REGIONAL PLANNERS, SAN FRANCISCO
DE LEUW, CATHER AND COMPANY, ENGINEERS, SAN FRANCISCO
A Joint Venture for Livermore-Pleasanton BART Extension Planning and Conceptual Engineering

R. T. Freebairn-Smith, Planning and Urban Design
Keyser/Marston and Associates, Economists
William Goldner, Urban Economic Consultant
Robert H. Twiss, Environmental Planning
Woodward-Lundgren and Associates, Consulting Engineers and Geologists

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CONTENTS

SUMMARY 1

FRAMEWORK FOR ANALYSIS OF URBAN DEVELOPMENT ALTERNATIVES
AND BART IMPACT 4

REGIONAL DEVELOPMENT ALTERNATIVES 11

REGIONAL DEVELOPMENT IMPACT OF BART SERVICE CORRIDORS 13

VALLEY DEVELOPMENT ALTERNATIVES 16

ROLE OF BART IN VALLEY DEVELOPMENT ALTERNATIVES 19

GENERATION AND EVALUATION OF STATION AND ROUTE ALTERNATIVES 22

BART CORRIDOR ALTERNATIVES 25

BART STATION ALTERNATIVES 30

BART VALLEY LINK ALTERNATIVES 37

SUMMARY DESCRIPTIONS OF SIX BART LINES 42

EVALUATIONS OF LINES 44

RECOMMENDATIONS FOR FURTHER STUDY 74

APPENDICES: A. Detailed Descriptions of Lines 78
B. Line Evaluation Forms 91



SUMMARY

The purposes of this report are to describe six alternate lines providing BART service to Livermore and Pleasanton, to explain how they were derived, to indicate reasons for prior rejection of alternatives, and to present preliminary impact information on local and regional development. The conclusion must be a recommendation that two or three of these lines be studied further in the immediately following evaluation phase. To arrive at that point this report must deal with the issues raised earlier in the study (Issues Report, October, 1972) and must apply the measures devised to determine whether possible objectives stemming from the issues are being met (Evaluation Criteria Report, February, 1973).

First, the choice of concentration or dispersion of employment within the Bay Area and the impact of alternate BART access corridors to the Valley on this question is discussed. Then, the development alternatives available to the Valley are studied and the extent to which Valley development can be influenced by BART is examined. The conclusion is that a BART extension will have only a minor impact on regional employment patterns and a moderate effect on the future urban patterns in the Valley. The major alternative to continuation of present development trends in the Valley would be a strong shift toward higher density housing with a consequent reduction in the amount of urbanized land for the same population. While BART is not expected to cause a major shift toward higher density, BART service to the Valley probably is essential if such a shift is to occur. With a new transit-oriented high density community of 35,000 persons and high density housing clustered around other BART stations, the 227,000 Valley residents expected in 1990 might occupy four square miles less land and need the equivalent of one less freeway lane than otherwise would be projected with BART.

The procedure used to develop the six BART corridor routes, 49 potential station sites, and two dozen Valley links shown on the Alternate Routes and Stations Map is described. Reasons for rejection of corridors, routes, stations, and major links that are not incorporated in the six lines evaluated are given. The Niles Canyon corridor is dropped because of low patronage, high cost per patron, longer travel times, poor service to Dublin-San Ramon, and environmental disruption.

The six lines selected for preliminary evaluation are described and measured for compliance with 9 of the 14 objectives specified in the Evaluation Criteria Report. Because lines in both the Dublin Canyon and San Ramon access corridors

fit nearly all alternate Valley stations and links, a decision on corridor alternatives can be made separately from a decision on lines within the Valley. Corridor evaluations are summarized as follows:

	Rank by Corridor	
	<u>Dublin Canyon</u>	<u>San Ramon</u>
<u>Growth</u>		
Objective 8: Minimize Valley population growth	2	1
<u>Cost</u>		
Objective 1: Minimize BART construction and operating cost	1	2
<u>Traveler Benefits</u>		
Objective 2: Maximize BART usage	1	2
Objective 14: Maximize compatibility with existing BART system and with other potential transit extensions	1	2
<u>Community Impacts</u> <u>(Urban Environment)</u>		
Objective 4: Avoid change in developed residential neighborhoods	1	2
Objective 5: Maximize environmental compatibility (Criteria 5 a. - c.)	1	2
Objective 6: Minimize inequities created by a BART extension	1	2
Objective 11: Maximize economic development at point of connection to existing BART line	2	1
Objective 13: Maximize compatibility with existing general plans	-	-
<u>Community Impacts</u> <u>(Natural Environment)</u>		
Objective 5: Maximize environmental compatibility (Criteria 5 e.)	2	1
Objective 7: Preserve maximum open space	2	1

The margins of superiority in cost, traveler benefits, and urban environmental impact for the Dublin Canyon corridor are so great that they cannot be overbalanced by somewhat better ratings for impact on the natural environment or by

favorable outcomes for the San Ramon corridor for criteria not evaluated during this phase.

Within the Valley, the characteristics of alternate lines have not yet been so clearly differentiated. Consequently, three Valley lines in conjunction with the Dublin Canyon corridor are recommended for further study with the findings to be presented in a Final Alternatives Report.

FRAMEWORK FOR ANALYSIS OF URBAN DEVELOPMENT ALTERNATIVES AND BART IMPACT

Ideally the study of a BART extension to Livermore and Pleasanton would be prepared with the aid of a predictive model of the Bay Area that would specify future changes in population, land use, economic activity, environment and BART patronage for each BART alternative. In the absence of such an integrated model, the best current work in each functional area must be relied upon. Following are the data sources used.

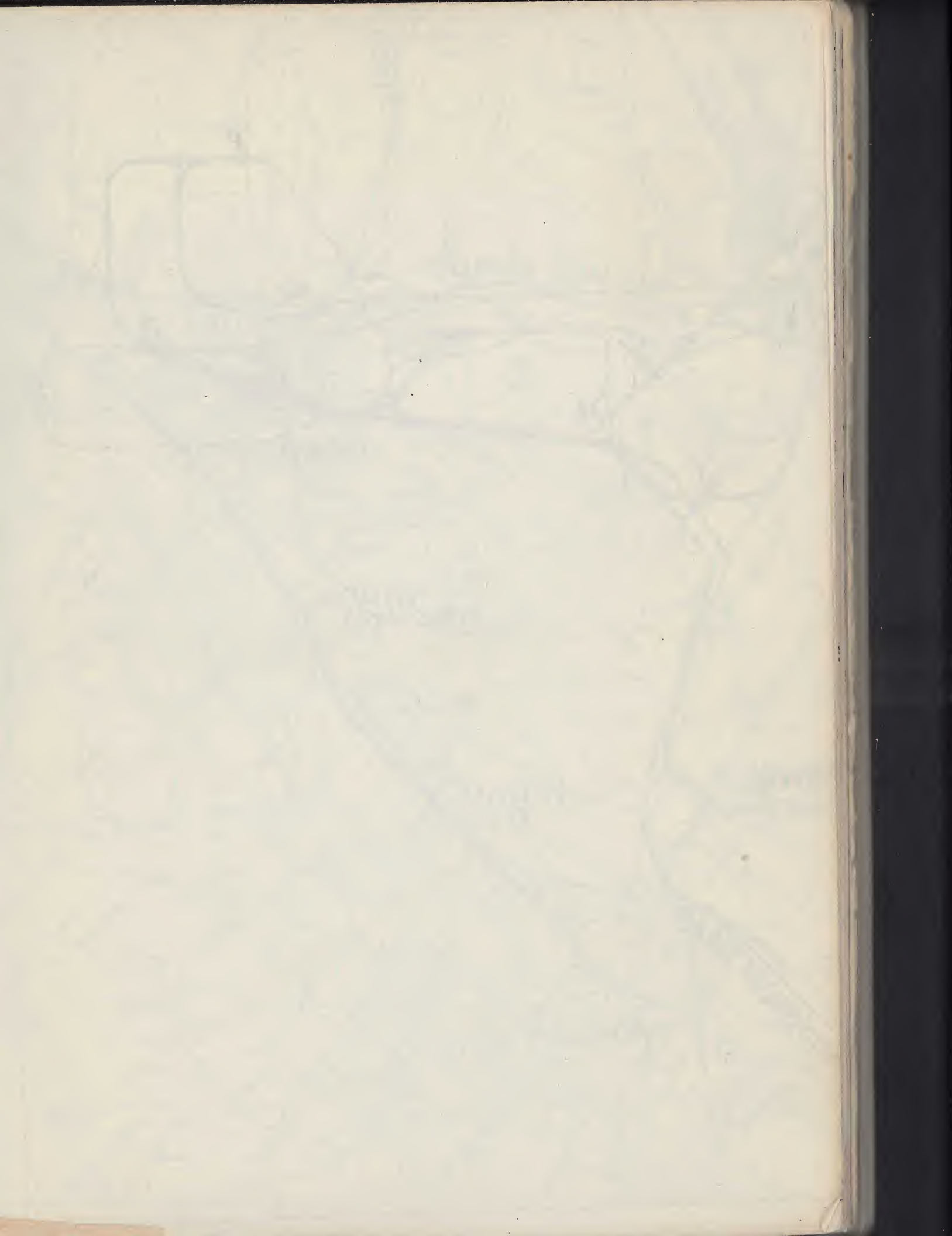
POPULATION

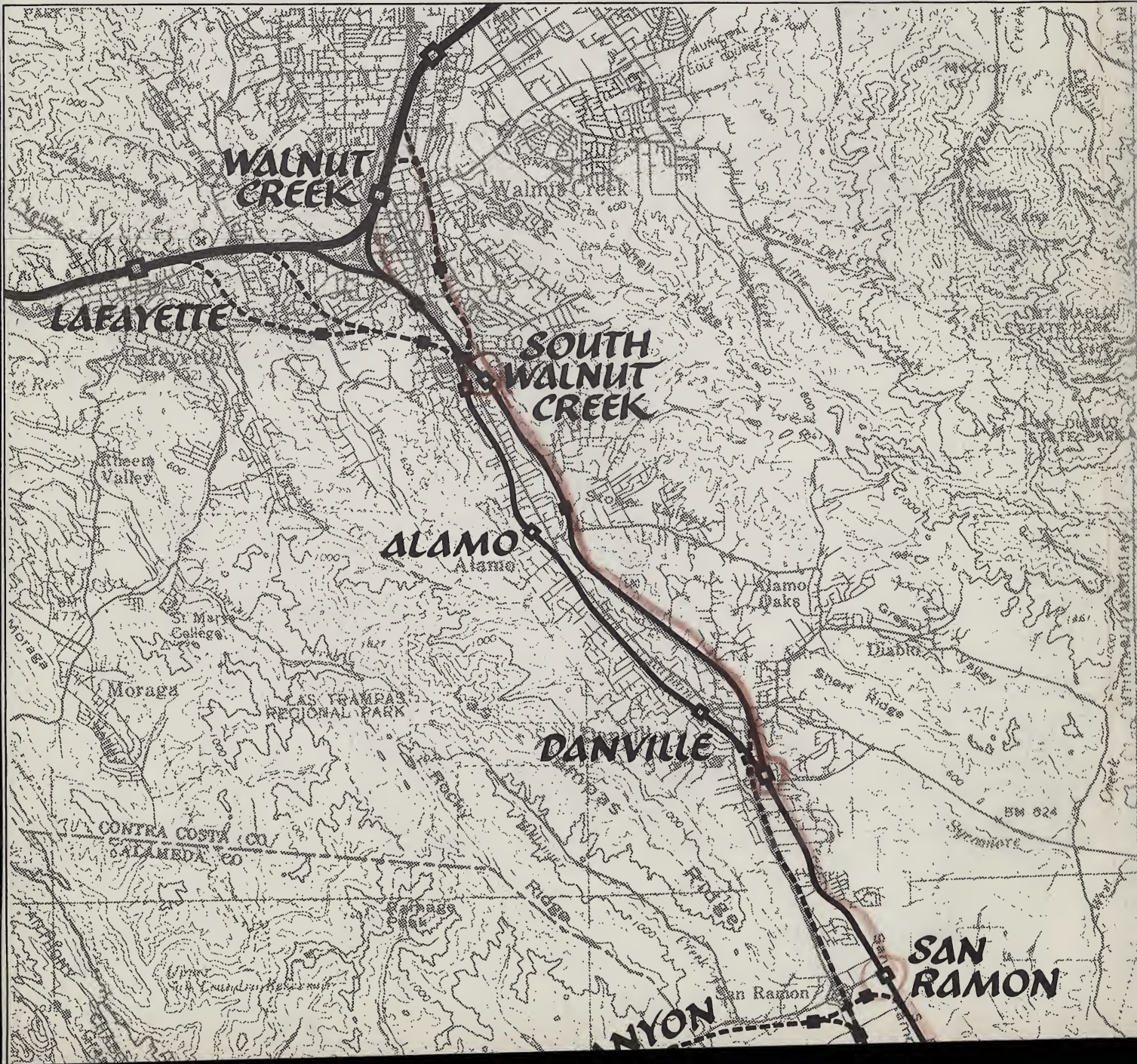
In the belief that population growth in the study area will be governed by local development policies rather than by unrestrained market demand, projections under three sets of policies published in the Issues Report are used. These appear in Table 1, followed by the assumptions on which they are based.

For this report a "high" 1990 population of 227,000 and a "low" 1990 population of 178,000 are used. Both figures are within a range that is consistent with the Association of Bay Area Governments (ABAG) moderate growth projections published in 1972. Recently released Alameda County Planning Department 1990 projections for the Livermore-Amador Planning Unit are 157,000 to 192,000, or 4 per cent and 10 per cent higher than the projections used by this study for the same geographic area (143,000 to 185,000).

EMPLOYMENT

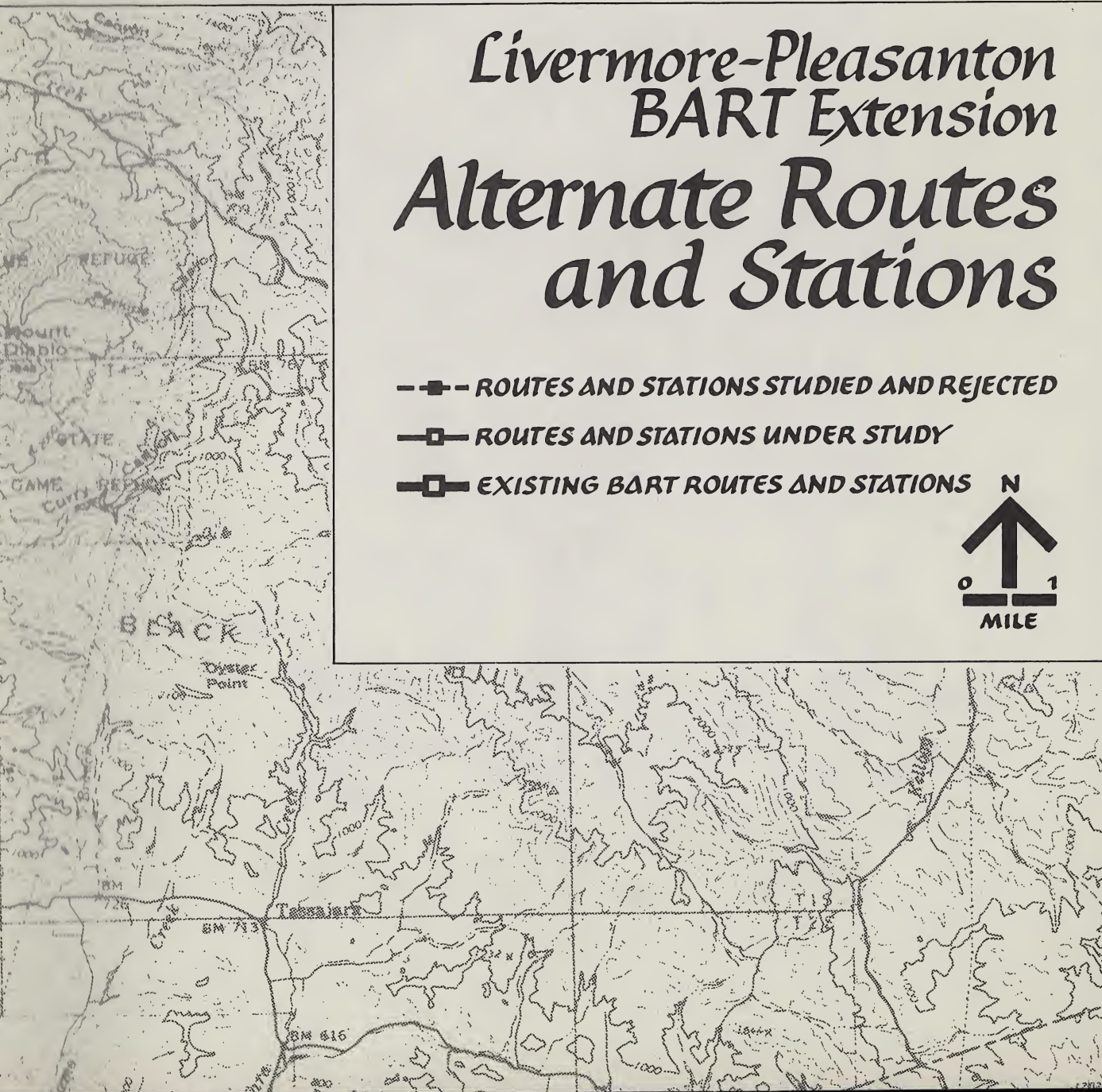
Two sources of employment projections are available. The ABAG-MTC BEMOD projections used for the Projective Land Use Model (PLUM) allocate 22,271 basic jobs to the Alameda County portion of the Valley in 1990 versus 11,643 in 1970. This regional allocation model tends to increase existing agglomerations and therefore may understate the potential in the Valley where plenty of moderately priced, highly accessible sites are available for manufacturing industry. With population serving employment added to BEMOD, the PLUM total employment projection in 1990 (with a PLUM population projection of 219,545 and a "South Bay emphasis") is 39,527. The PLUM projections reflect the broad framework provided by the ABAG Regional Plan 1970: 1990, as approved in 1970. They do not reflect any other regional or local development policies or changing attitudes and environmental constraints and should therefore be viewed as provisional projections that have not been subject to rigorous planning evaluation.





Livermore-Pleasanton BART Extension Alternate Routes and Stations

- ROUTES AND STATIONS STUDIED AND REJECTED
- ROUTES AND STATIONS UNDER STUDY
- EXISTING BART ROUTES AND STATIONS



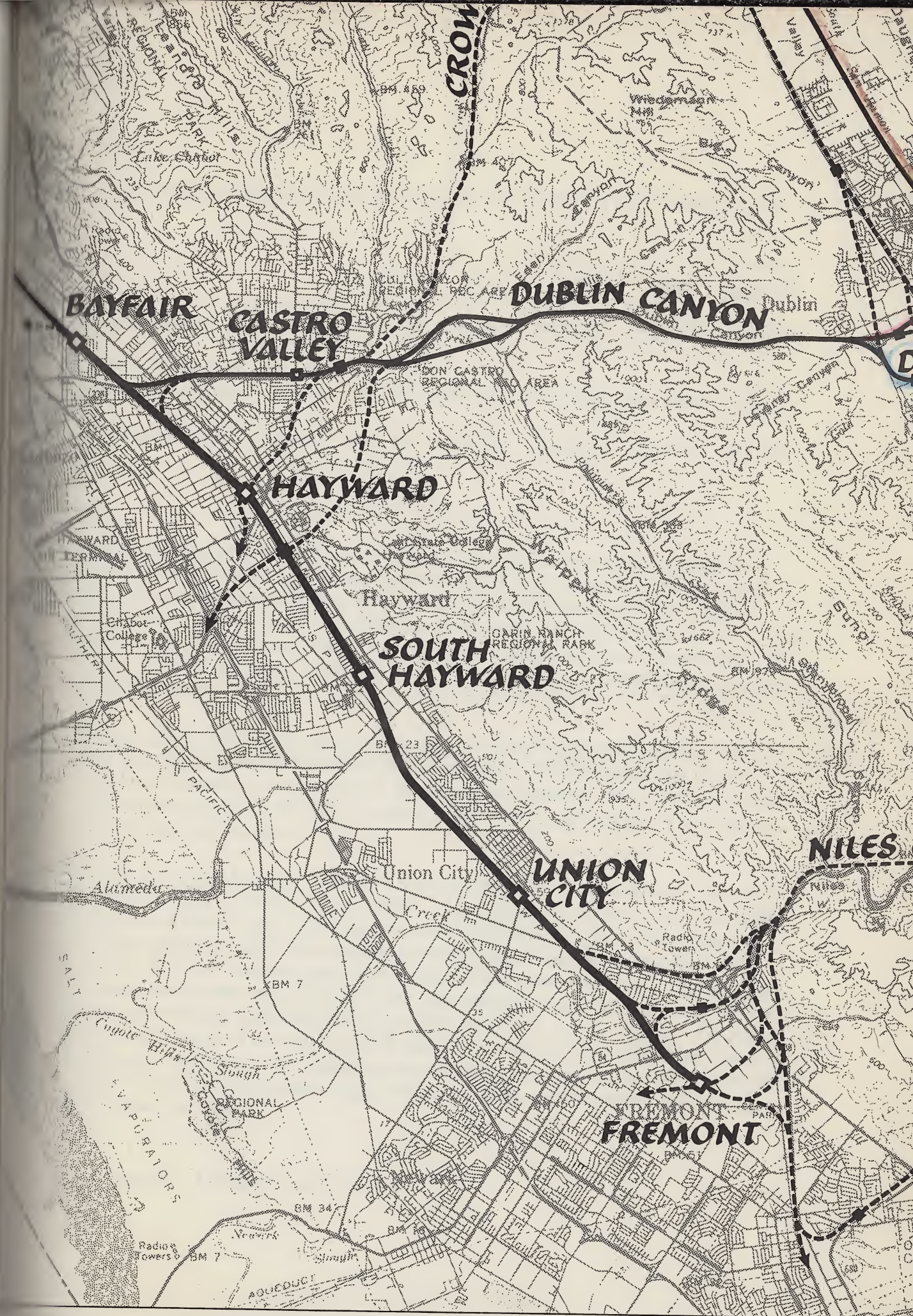
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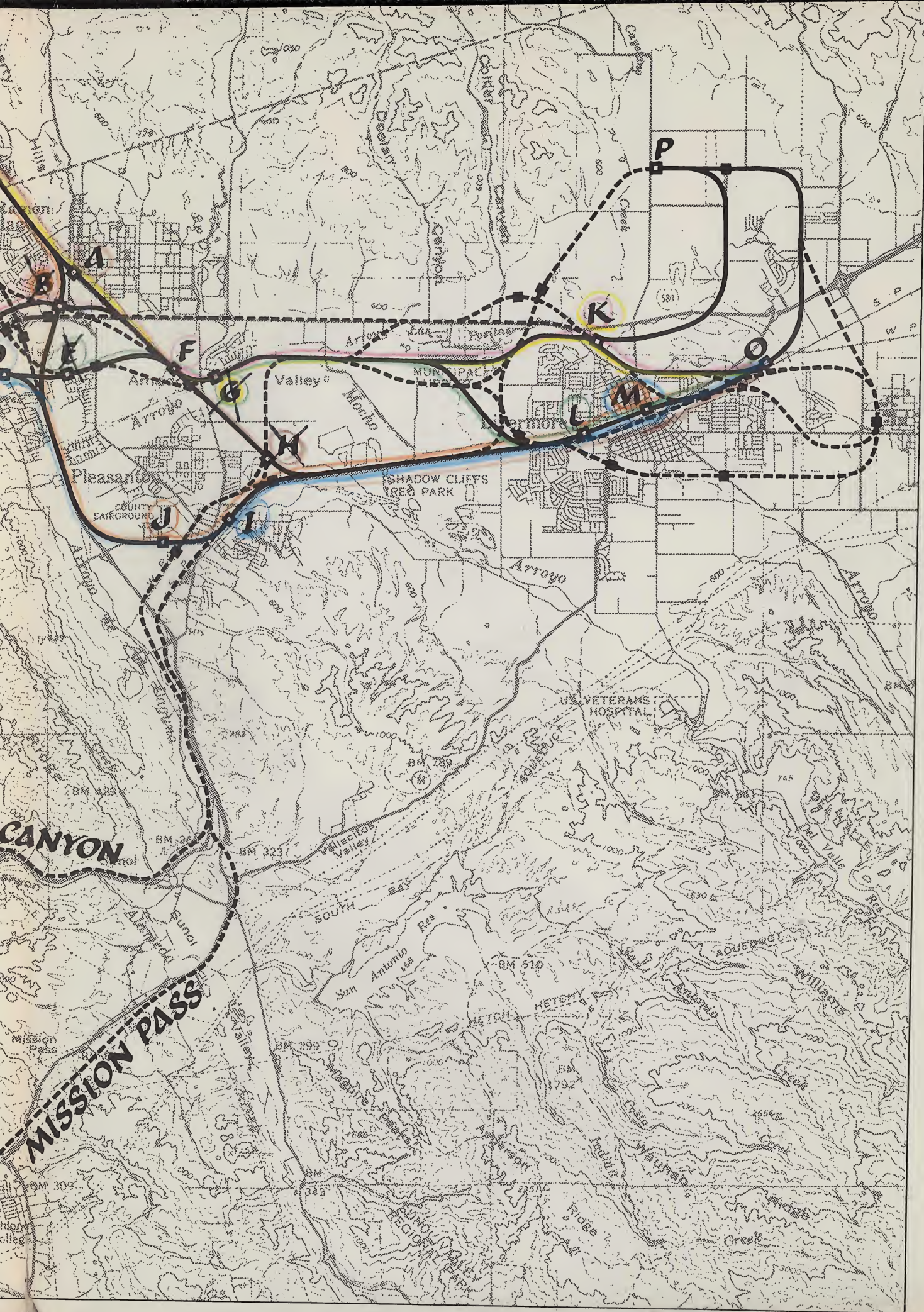
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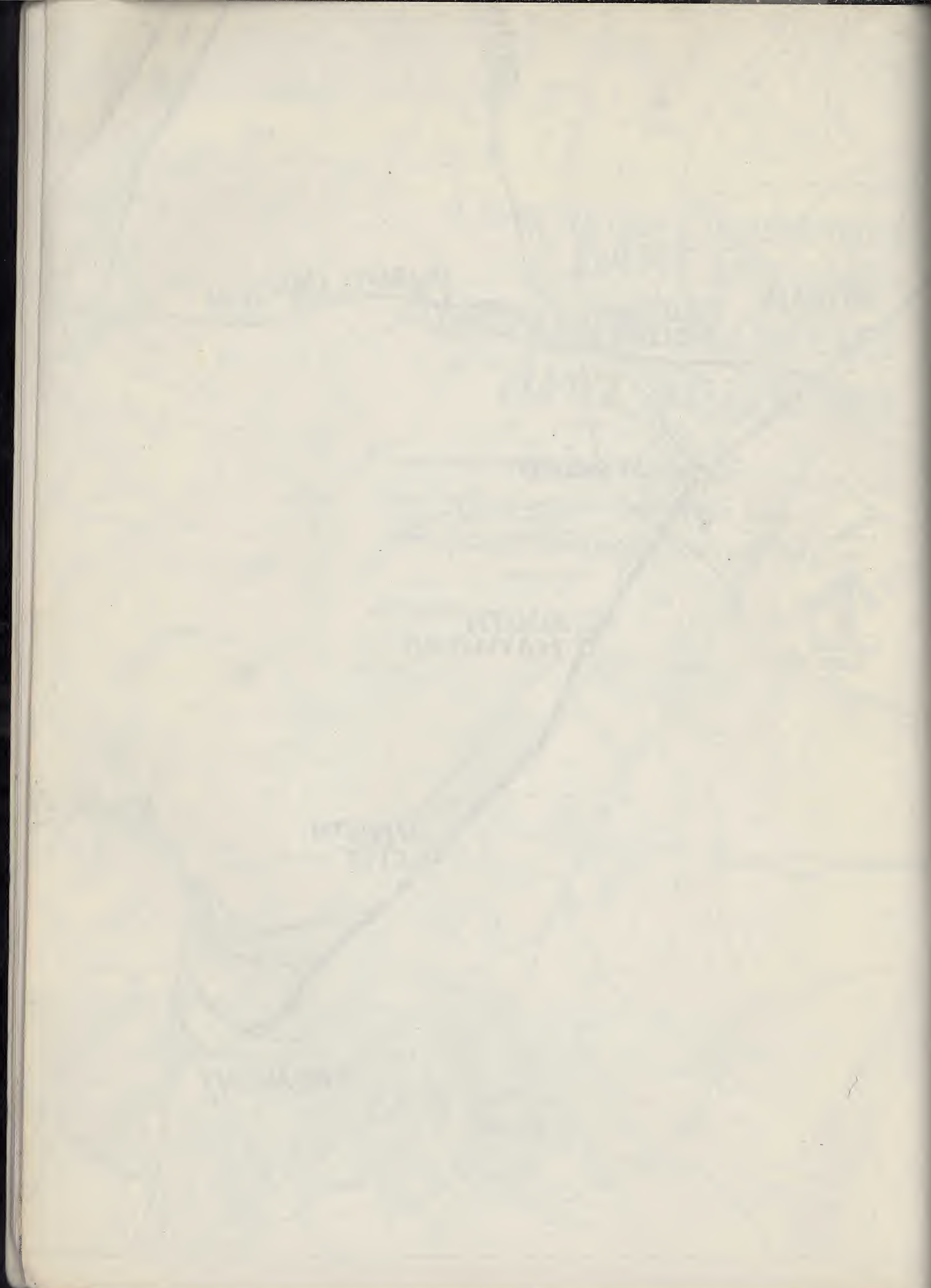


Table 1:

LIVERMORE-AMADOR-SAN RAMON VALLEY POPULATION PROJECTIONS

	<u>1970</u>	<u>1980</u>	<u>1990</u>	<u>2000</u>	<u>Holding Capacity</u>
Full Development ^{a.}	86,000	175,000	240,000	303,000	414,000
General Plans and Growth ^{b.}					
Rate Limitations	86,000	169,000	227,000	292,000	359,000
Sharply Curtailed Growth ^{c.}	86,000	145,000	178,000	210,000	252,000

a. Full Development: Projects growth applying typical subdivision densities suited to topography to all potential residential land shown on general plans and other lands with less than 20 per cent average slope, assuming recent growth rates (Livermore, 760 housing units added per year; Pleasanton, 1,000; Dublin, 200; San Ramon, 500). This alternate assumes that the vineyards will not be retained and that, as in the Santa Clara Valley, general plan proposals will not prevail.

b. General Plans and Growth Rate Limitation: Projects growth in accord with the current general plans for Livermore, Pleasanton, Dublin (Alameda County), San Ramon (Contra Costa County), assuming 800 housing units added per year in Pleasanton and growth rates in other areas at the same levels as in the full development alternative.

c. Sharply Curtailed Growth: Projects growth subject to limitations on both rate and total holding capacity of the Valley. Livermore: All open space shown on County Open Space Plan, rural and estates residential areas, other lands further than one-half mile from existing development, and an additional 1,500 acres of flat land remain open; 500 housing units added per year. Pleasanton: All lands south and east of the present City boundary and 500 additional acres of flat land remain open; 500 housing units added per year. Dublin: Proposed low density areas in the hills remain open; 200 housing units added per year. San Ramon: Proposed low density areas in the hills and the area designated for medium density development along Dougherty Road remain open; 400 housing units added per year.

Source: Livingston and Blayney

Alternate projections were prepared by the study team based on the following assumptions:

- 227,000 population, 1990
- 79,450 employed residents, 1990 (35 per cent of population vs. 34 per cent, 1970)
- 43,700 employed residents commuting out of the Valley, 1990 (55 per cent vs. 48 per cent in 1970)
- 17,750 local jobs held by in-commuters (33 per cent, same as in 1970)
- 5,500 employees at the Livermore Radiation Laboratory (constant).

The projections are summarized in Table 2.

The employment composition forecast reflects a judgment of the mix of economic activities that is likely to be found in the Valley at the stages of economic maturity through which it will be passing. The 1970 employment composition is marked by unusually low percentages in trade, finance, insurance, and real estate and by an unusually high percentage in government. The projections show these categories tending to more normal levels. The increase in services is not as sharp as is usually projected based on national and regional trends, since the current percentage is well above regional averages and very close to a future level that would represent reasonably balanced development.

Projections of out-commute, which have a strong impact on BART patronage, vary considerably. The Regional Transit Travel Projections Project (RTTPP) projects 48 per cent in 1990, while PLUM has an apparently unrealistically high 67 per cent of Valley residents working outside the Valley in 1990.

REGIONAL TRANSIT TRAVEL PROJECTIONS PROJECT (RTTPP)

The Livermore-Pleasanton BART Extension Study relies on RTTPP for projections of patronage in the alternate corridors. Task I of RTTPP, completed in early January, produced order of magnitude estimates based on Bay Area Transportation Study (BATS) data, on more recent ABAG-MTC employment forecasts (BEMOD), on Department of Finance population projections (Alternate C-300), and on population projections for the Livermore-Amador-San Ramon Valley provided by the study team (227,000, 1990). The analysis was based on a system of 290 regional analysis zones, one of which includes nearly all of the Valley.

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TABLE 2: EMPLOYMENT PROJECTIONS
LIVERMORE-AMADOR-SAN RAMON VALLEY

	<u>1970</u> ^{a.}		<u>1980</u>		<u>1990</u>		L.A. -20%
Total	22,800	100.0%	39,900	100.0%	53,500	100.0%	
Agriculture	1,600	7.0%	1,300	3.3%	1,000	1.9%	
Construction	700	3.0%	1,000	2.5%	1,200	2.2%	
Manufacturing	1,900	8.3%	5,500	13.8%	7,700	14.4%	
Transportation, Communication & Utilities	400	1.8%	500	1.3%	600	1.1%	
Trade	2,500	11.0%	6,200	15.5%	9,300	17.3%	
Finance, Insurance & Real Estate	700	3.0%	1,400	3.5%	2,100	3.9%	
Services	5,000	22.0%	9,600	24.0%	13,800	26.0%	
Government ^{b.}	4,400	19.3%	8,700	21.8%	12,000	22.4%	
Other	100	.5%	200	.5%	300	.5%	
Radiation Laboratory	5,500	24.1%	5,500	13.8%	5,500	10.3%	

Source: Keyser/Marston and Associates projections

a. Alameda County portion of Valley employment from California Department of Human Resources Development; Contra Costa County portion of Valley employment from Keyser/Marston and Associates estimate.

b. Excludes Radiation Laboratory

Three sets of projections were prepared: high and low forecasts for 1980 and a high forecast for 1990. The HITRANS projections assume that BART riding time is more desirable than bus riding or auto driving time and has a 25 per cent lower value while the LOTRANS projections assign equal value to time spent riding or driving.

TABLE 3: RTTPP CORRIDOR PATRONAGE PROJECTIONS
(Average Daily Work Trips Based on Trip-end Summaries)

<u>Corridor</u>	1980 <u>LOTRANS</u>	1980 <u>HITRANS</u>	1990 <u>HITRANS</u>
Dublin Canyon Corridor - with South Bay Loop	15,391	20,701	29,177
San Ramon Corridor		18,675	
Niles Canyon Corridor - with Dumbarton crossing		12,158	30,035

It is not possible to determine from available data what proportion of the 1990 trips are attributable to the South Bay Loop or the Dumbarton crossing.

For the only comparable set of assumptions, trip-end summaries for Dublin Canyon exceed Niles Canyon by 70 per cent and San Ramon by 11 per cent. However, RTTPP does not show that total BART patronage is sensitive to corridor selection, probably because the analysis zones are so large. The total number of BART work trips produced and attracted with BART in alternate corridors varies by less than one per cent of the total work trips in the study area. Thus the apparent assumption is that BART patrons who would not be well served by a Niles corridor line would board BART at Bay Fair or Walnut Creek. The model also indicates little dependence on corridor selection in the BART 1980 work trip attractions to the possible points of connection. When alternate corridors are assumed, BART trips attracted to Walnut Creek, Hayward, and Fremont vary by less than one per cent of all trip attractions.

Transit accounts for about 13 per cent of all trips produced in the study area and about 5 per cent of all trips attracted. The maximum share of intra-Valley trips on transit is 5 or 6 per cent. RTTPP projections show one-third of the outbound commuters and one-fifth of the inbound commuters using BART. Trip tables show that 63 to 75 per cent of the outbound commuters using a Valley extension are headed for Oakland or San Francisco.

RTTPP, Task 2, will provide refined projections for five transit modes, for all trip purposes, and for alternate populations. Smaller analysis zones will be used (the Valley will have 17 zones instead of one). Task 2 projections are not expected to be available until June, after the LPBES route selection has been made.

PROJECTIVE LAND USE MODEL (PLUM)

The increase in accessibility resulting from a BART extension will cause more people to seek residential locations in the Valley. The magnitude of the pressure can only be gauged by a regional model that can measure the changes in relative accessibility and land availability at alternate locations. It had been hoped the ABAG-MTC's PLUM model could be used to measure BART's growth impact by the population it assigned to the Valley with and without BART.

The only current PLUM runs available are based on a free-flow highway network. No consideration is given to current or potential peak hour congestion or to a relative gain in accessibility that would result from BART. PLUM will not have the ability to assign trips by mode.

The only scheduled modification of PLUM is addition of a peak hour network that will assign on the basis of the fastest mode, thereby eliminating any highway congestion constraint and overstating the impact of a BART line. Even this might be of some use in getting a sense of BART impact if a peak-hour no-BART network also were to be tested, but it has not been determined whether this will be done. The PLUM 1990 baseline projection for the Alameda County portion of the study area is 219,000, 19 per cent above the 185,000 high projection used for this study. The only conclusion to be drawn from current PLUM runs is that development pressure will be high if accessibility is high.

AIR POLLUTION AS A GROWTH CONSTRAINT

It often is contended that the limitation on the population of the Valley will be the ability of the air shed to absorb pollutants. At the outset of this study tests of the impact on air quality of alternate population levels with and without BART service were planned in accord with an offer made more than a year earlier by the Bay Area Air Pollution Control District (BAAPCD).

In the interim the state of the art of forecasting levels of pollution has advanced rapidly and further major advances are expected during the next two years. The district has developed a model for use in Marin County that predicts the number of times specific air quality standards for carbon monoxide, nitrogen oxide,

particulates, and hydro-carbons will be exceeded by square kilometer for alternate land use and transportation systems. However, no models currently available can predict regional and local impact of BART and growth on ambient concentrations of photochemical oxidants. A major effort is underway by the BAAPCD, the Lawrence Radiation Laboratory, and the Ames Research Center with a \$657,000 grant from the National Science Foundation to study how growth in the Bay Area will affect air quality in the Valley. The results of this study, although two or more years away, should make it possible to determine the constraints air quality would place on Valley growth if the standards of the Clean Air Act are to be met.

Preparation of the data required for the Marin type model is beyond the scope of the LPBES, and the BAAPCD would require reimbursement for its work. The expenditure does not appear warranted when a much superior study is underway, so no comprehensive air quality study will be made at this time. The direct impact of BART on emissions through a reduction of the vehicle miles of travel will be calculated. High and low population projections for the Valley will be carried through the study to provide benchmarks for application of the results of the LRL/BAAPCD/Ames study.

REGIONAL DEVELOPMENT ALTERNATIVES

If rail transit is best suited to carrying employees to areas of high employment concentration within walking distance of a station, then it will increasingly serve office workers who form a growing percentage of all employed persons. To the extent that the location pattern of regional office complexes is influenced by transit accessibility, a BART extension can reinforce current trends or give impetus to a change. In the Bay Area the alternatives are to increase the concentration of regional offices in downtown San Francisco and to a lesser extent in Oakland, or to promote the development of regional subcenters. The ABAG Regional Plan of 1970 advocates a city-centered concept consisting of a system of communities "large enough to be able to specialize economically", and suggests that "surrounding communities would be less dependent on the metropolitan centers." ABAG does not take a position on whether regional office employment should be centralized or decentralized.

Currently the momentum is toward centralization of region-serving offices. During the early 1960's San Francisco was adding less than 800,000 square feet of office space per year. Between 1968 and 1970 this increased to an average of 1.2 million square feet per year, and the current rate of increase is 1.6 million square feet and 9,000 jobs added each year. Between 1967 and mid 1971, 45 per cent of the total value of office building permits in the nine county Bay Area was in San Francisco. The 20 year outlook in San Francisco is for addition of 1-1.2 million square feet of office space and 5,700-6,900 office jobs each year. Office employment gains will continue to be partially offset by the exodus of manufacturing and distribution industries to suburban locations. BEMOD projects a net gain of only 58,000 jobs in downtown San Francisco between 1970 and 1990 (295,000 to 353,000). Oakland's central business district employment will increase by 59,000 according to BEMOD (64,000 to 123,000).

The prestige and convenience of locations at the regional core apparently outweighs the higher cost of space, and the higher costs of housing or journey to work are transferred to the employees. The continuing office boom has greatly changed the appearance of downtown San Francisco, and, in the minds of many, the change has been for the worse. However, the height and bulk of recent office buildings is not an inevitable consequence of a demand for more space. The same amount of space could have been added in more smaller buildings.

Construction of BART has helped give impetus to further centralization as it was intended to do, but it would be an overstatement to say that BART is responsible.

RTTPP projections indicate that a BART extension providing the best service to Oakland and San Francisco would draw the highest patronage. As well-paid office workers must travel further to find new single family homes in homogeneous communities, their automobile commute becomes more onerous and they readily can be attracted to high quality transit. RTTPP 1990 high projections show 107,000 work trips in the BART transbay tube, well within capacity.

If some of this regional office development could be directed to smaller centers in the region, total travel would be reduced. Retailing already is highly decentralized as are most services provided directly to consumers. So far, the Bay Area exhibits little tendency to form subregional office clusters such as those found in Westwood and Pasadena. When offices are built outside the regional core, as in Palo Alto or San Jose, the employees tend to live closer to their work places in a scattered pattern that is not well adapted to transit service. To be competitive under current conditions, outlying offices must be planned for full reliance on automobile travel. Once the automobile is accommodated, the employment density is too low for efficient transit service and the ease of driving and parking prevents transit from becoming competitive.

If regional development policy were to discourage further intensification of development in the metropolitan core cities, BART should not have been built. It cannot help but favor additional development where high densities already exist. BART will cause relocation of some office development that would have occurred in outlying areas in any event, but it is unlikely to attract a significant amount of potential development from downtown Oakland and San Francisco to outlying BART-served locations. A decision to extend BART to Livermore and Pleasanton will reinforce a centralized regional office employment pattern.

REGIONAL DEVELOPMENT IMPACT OF BART SERVICE CORRIDORS

Choice of the corridor for extension of BART to the Valley will have an impact on regional development. This section discusses the direction and magnitude of the impact, leaving route and station alternates for later description.

DUBLIN CANYON CORRIDOR

If present commute patterns are to be served most efficiently, Dublin Canyon is the obvious choice, and RTTPP assigns it the highest 1980 work trip patronage. Oakland or San Francisco will be the destinations of 63 to 75 per cent of BART Valley commuters, and Dublin Canyon is 7.5 minutes faster than Niles Canyon and 13 minutes faster than the San Ramon corridor to Oakland City Center. By minimizing commute time, the Dublin corridor favors continued expansion of employment in downtown San Francisco and Oakland. Conversely, if expansion in the metropolitan core is anticipated whether or not BART is extended, the Dublin corridor will minimize total travel and total automobile travel. The Dublin corridor would serve only Castro Valley in addition to the Valley communities. The 63,000 residents of Castro Valley (1990) would have improved BART service, but most of the potential patrons would use the Bay Fair station if the Dublin corridor line were not built. Assuming the Valley extension joins the existing line at Bay Fair, a much more direct and easily reached junction than downtown Hayward, little additional development could be expected to result from BART. Although the Bay Fair regional shopping center adjoins the station and there is good freeway accessibility, the area lacks a positive image and there is little vacant land.

SAN RAMON CORRIDOR

Choice of the San Ramon corridor would have some influence on the distribution of jobs, but there would be substantial disbenefits for many BART riders. A BART connection to the Walnut Creek station could be expected to result in an increase of 1,900 jobs within walking distance of the station by 1990 (a 5 per cent increase within the Walnut Creek General Plan area).

Development pressures in downtown Walnut Creek are expected to be strong with or without a BART extension. In spite of loss of central Contra Costa County retail dominance to Sun Valley shopping center, retailing in Walnut Creek remains healthy and the recent commitment of Bullock's to locate a new store in the central business district adds to its prestige. Lack of vacant land

is not expected to curtail growth. Walnut Creek has been the location of new subregional office development, notably the new highrise Fidelity Savings Building adjoining the BART station. The community's prestige and convenience to high quality residential areas, its access to the regional core via freeway and the present BART line, and its confined downtown area that will force compact development, all point toward a continuation of the trend. However, there is no reason to believe that a BART connection would divert more than one or two per cent of San Francisco's potential regional office employment gain during the next 20 years. This doesn't mean it could not happen, but there is no basis for predicting a greater change as a result of a BART extension. If a sizable shift is not a likely possibility, there is little reason to connect the Valley to another area that is expected to have a large net out-commute rather than directly to the areas that have a surplus of jobs over living space.

For Valley commuters working in Oakland or San Francisco, a San Ramon BART line would mean an extra 20 to 36 minutes spent traveling each day compared with the Dublin Canyon corridor. RTTPP 1980 HITRANS work trips are projected at 90 per cent of the Dublin Canyon volumes. More seriously, the 1980 HITRANS projections indicate that 55 per cent of the peak hour passengers on the Concord Line with a San Ramon extension would be standees, compared with 29 per cent for San Francisco bound trains on the Fremont Line with a Dublin Canyon extension. Trains headed for Oakland on the Fremont Line would have empty seats. Increased capacity on the Concord Line could be provided by adding tracks through the Oakland Wye or by running some trains only as far as MacArthur Station, but neither of these solutions is attractive.

NILES CANYON CORRIDOR

A Niles Canyon route would carry only 59 per cent as many work trips as a Dublin Canyon line. However, RTTPP 1990 HITRANS projections show the Niles Canyon route with a Dumbarton Crossing attracting about the same patronage as the Dublin Canyon route with a South Bay loop. The Dumbarton crossing would serve the Palo Alto-Menlo Park area, which now has a net in-commute, if riders were willing to transfer to buses at the job end of the trip to reach dispersed employment locations. Three-fifths or more of all riders on a Niles Canyon route would have destinations north of Fremont and would have longer travel times than on a Dublin Canyon line. Oakland and San Francisco trips from the Valley would take 7.5 minutes longer. Unless a Niles Canyon line were oriented toward a Dumbarton crossing, connection to the Fremont station is less direct than

connection at a point between the Fremont and Union City stations. Connection to the Fremont station in the designated central business district would have some beneficial effect in establishing a subregional center, but no significant BART influence on regional office or retail development is expected until after 1990.

VALLEY DEVELOPMENT ALTERNATIVES

Given the assumption that Valley population will increase from 100,000 in 1972 to 178,000-227,000 in 1990, what alternative forms might new development take? Since about half of the 1990 population already resides in the Valley, mostly in relatively new housing, the potential for change in present trends will depend on the location and density of the 26,000 to 42,000 housing units to be added. If new housing occupies the same land per unit as existing housing and if commercial and industrial uses expand proportionately, 39 to 45 per cent of the Valley's buildable land under 20 per cent slope will be urbanized, compared with 28 per cent today. Already tentative or final subdivision maps have been approved authorizing approximately 4,600 new units, 4,000 of which are single family homes. If maintenance of reasonably compact communities, each with its own identity, is an objective, continuation of market trends and present regulatory policies probably will achieve it. However, this pattern will sharply reduce the amount of open space in the Valley and is less suited to transit service than higher density development.

Table 4 describes existing land use and illustrates three Valley population and density alternatives that could be attained by 1990. In 1972 only 10 per cent of the Valley's housing was high density. Most high density units are apartments; few townhouse or zero lot line units have been built. Unless regulatory policies intervene, the ratio of high density units will increase sharply by 1990. The example of Santa Clara County, a rapidly developing and admittedly larger and more diverse urban area, illustrates a typical trend as maturity is approached. In 1960 Santa Clara County had only 17 per cent high density units, but during the 1960-70 decade 53 per cent of the units built were high density and by 1970 the high density share was 43 per cent.

The reasons are rapidly rising housing costs, led by land costs, plus the adaptability of a greater proportion of the population to apartment living as fewer young unmarried people leave the community and the families who arrived early no longer have children living at home. If a sharply curtailed growth policy prevails in the Valley (178,000 population in 1990) the high density housing share might reach only 25 per cent by 1990 as builders would seek to devote their limited share of permits to single family homes because the market would be strong and profit margins are higher. Under the more liberal population assumption (227,000 in 1990) a high density share of 35 per cent would be a likely expectation.

	1972	1990 Low -		1990 High -		Strong Shift to Higher Density Housing		
		Sharply Curtailed Growth	General Plan Growth Rate Limitation	New Community	Valley		Total	
					Remainder	Valley		
Population	102,000	178,000	227,000	227,000	35,000	192,000	227,000	
Single family housing units	26,300	41,700 ^{75%}	46,100 ^{65%}	46,100 ^{65%}	0	35,500 ^{50%}	35,500	
High density housing units	2,800	13,900 ^{80%}	24,800	24,800	11,700	23,800 ^{71.8%}	35,500	
Single family acres	6,800	11,000	12,200	12,200	0	9,400	9,400	
High density acres	200	900	2,200	2,200	600	1,600	2,200	
Total residential acres	7,000	11,900	14,400	14,400	600	11,000	11,600	
Retail acres	400	660	840	840	60	730	790	
Office acres	50	90	110	110	20	90	110	
Industry acres	1,200	1,800	2,300	2,300	100	2,200	2,300	
Quarry acres	2,600	2,600	2,600	2,600	0	2,600	2,600	
Orchard acres	840	30	30	30	0	30	30	
Vineyard acres	1,860	2,270	2,060	2,060	0	2,270	2,270	
Community facilities acres	3,000	4,000	4,400	4,400	700	3,700	4,400	
Major street, rail & utilities R.O.W.	2,950	2,950	3,550	3,550	100	3,450	3,550	
Vacant developable acres	42,300	35,900	31,900	31,900	3,920	30,630	34,550	
Total developable acres	62,200	62,200	62,200	62,200	5,500 ^a	56,700	62,200	
Total urbanized acres ^b	17,200	24,000	28,200	28,200	1,580	23,770	25,350	
Per cent urbanized	27.7	38.6	45.3	45.3	28.7	41.9	40.8	

a. Valley zones 36, 37, 38, 40, 41, 42, 43 and 44

b. Excludes orchard/vineyard

Source: Livingston and Blayney

Using the same population projection and assuming a strong shift to higher density living, the non-single family detached share (multi-family, townhouse, zero lot line house, patio house, etc.) might reach 50 per cent of the total stock. Under this assumption only 9,200 new single family detached homes would be built during the period, or 5,200 more than are already approved. About 78 per cent of all new units built would be high density. Assuming an average density of 16 units per gross acre for the non-single family units 1,360 more acres would be urbanized than with 178,000 people and 25 per cent high density, and 2,840 less acres would be used than with 227,000 people and 35 per cent high density units. With housing costs rising faster than personal income, such a strong shift to high density living is not an unrealistic possibility, but it would require some changes in public taste and a quality of design of high density housing that is rarely found today. One of the changes in public preferences that would make it possible would be a desire to live within walking distance of BART. The shift will come only if encouraged and forced by strong local development policies. Support for such policies would be based on a desire to preserve open space and reduce dependence on the automobile, and probably would be coupled with a program for large scale permanent preservation of open space either through acquisition or by allowing developers to build only on a small portion of their sites.

One way to carry out a high-density-with-open-space policy would be to create a high density transit-oriented new community as described in the next section.

ROLE OF BART IN VALLEY DEVELOPMENT ALTERNATIVES

BART's main influence on the development pattern of the Valley will be in attracting housing built for a commuter market to locations near the stations. With two-thirds of Valley jobs held by persons living in the Valley and only 5 per cent of intra-Valley work trips on BART (per RTTPP), there will be little influence on the choice of residential location for the 45 per cent of all Valley employed persons who are not out-commuters.

The RTTPP modal split indicates that only a portion of the available housing within walking distance of BART stations will be occupied by BART commuters. Assuming 43,700 out-commuters with one-third on BART (per RTTPP) 14,400 commuters representing a total family population of 41,200 might want to live within walking distance. However, the proportion of commuter households that prefer and can afford single family houses is likely to be high. Better than 90 per cent of present commuters live in single family houses. Land within walking distance of BART stations is expected to be priced too high for single family development. If, for example, only 25 per cent of all BART commuters will accept high density housing, the total commuter household population wanting to live near stations would drop to 10,300 persons needing 3,400 housing units. All of the sets of stations under consideration could accommodate at least twice that much housing.

If all new Valley residents who are out-commuters wanted to live within walking distance of BART, there would be a demand for 23,400 housing units near stations. Since only one-third of the out-commuters are projected to be BART riders, the demand would drop to 7,700 nearby units, an amount within the 7,200 to 9,300 unit capacity range of the areas within walking distance of four Valley BART stations. (See measures of criterion 2a. - Appendix B.) Of course not all housing near BART stations will be occupied by BART riders. By 1990, 11,000 to 22,000 high density units are expected to be built in the Valley without any major shift to high density. Since rental units would benefit from locations attractive to BART commuters even though many tenants would not use BART, the areas within walking distance of the stations would be fully developed. Thus, under a projection of probable trends, BART's major influence on urban form would be to cause about half of the new high density housing to cluster near stations.

While there is no evidence to show that BART would cause a shift in housing types, a strong shift to higher density probably could not be accomplished without BART.

An important element in attracting a larger share of the new population to high density housing would be a desire for reduction of dependence on the car, whether for reasons of convenience or cost. If 78 per cent of the residents added by 1990 live in high density housing (50 per cent of all residents) and 59 per cent of new employed persons commute outside the Valley (55 per cent of all employed persons) it seems reasonable to assume that 50 per cent (instead of 33 per cent) of these new commuters might ride BART if it were sufficiently convenient. This would create a market for housing for 29,200 persons within walking distance of BART, equalling or exceeding the capacity adjoining four Valley stations if all nearby residents were BART commuters.

This potentially unsatisfied demand for housing near BART would provide the opportunity to create a "new community" with maximum orientation to transit. With imaginative planning, 35,000 people could live in 11,700 housing units at 20 units per acre all within walking distance (assisted by moving sidewalks and horizontal elevators). A possible site would be north of I-580 at Livermore where the community might logically be within the Livermore city limits and would be 45 minutes by BART from Oakland-Lake Merritt via Dublin Canyon. If the BART-oriented community were completed by 1990, the remainder of the Valley would be composed of 40 per cent high density housing, only 5 per cent above the share projected with no conscious effort to shift to high density, but there would be 2,800 acres (4 square miles) of additional open space and 4,400 fewer daily one-way commute trips on the highways, the equivalent of more than a freeway lane capacity.

Development of the new community could not start before BART service. If it were to be fully developed between 1980 and 1990 it would have to attract 10 per cent of the population gain in Alameda and Contra Costa Counties (ABAG moderate growth projections) and half of the Valley growth during the period. These are high but not unattainable shares.

Retailing and offices will attract mainly intra-Valley trips, few of which BART would carry, and therefore will not concentrate near BART stations except to serve population in the immediate area. The exception would be that if a BART station enhances the identification and prestige of a commercial complex that is viable without BART, some additional office development may be attracted. In 1990 a maximum of about 12,500 jobs (25 per cent of all Valley jobs) are likely to be located within walking distance of Valley BART stations if a line with the set of stations having the greatest employment potential were selected. If one-third of all Valley jobs are held by in-commuters and one-fifth of these employees ride

BART (per RTTPP), there would be 2,600 BART in-commuters in 1980. RTTPP, using a lower employment total, projects 1,700 in-commuters. If five per cent of intra-Valley work trips were via BART, there would be an additional 1,800 patrons. Since those who could walk to work from a BART station are more likely to use BART, it seems reasonable to project that 1,100 to 2,200 of those employed near stations would be BART riders.

Within the range of BART's potential to influence or make possible alternate patterns of Valley development, there is no urban form that will drastically reduce dependence on the automobile. The 227,000 residents in 1990 will generate on the order of 700,000 trips a day in the Valley (10 per housing unit). If BART were to carry 50,000 trips a day out of the Valley, exceeding line capacity with 6 minute headways and far surpassing RTTPP projections, it would account for only 7 per cent of all trips. Local bus systems in similar communities typically carry one to two per cent of all trips. Even in a high density city such as San Francisco that has intensive transit service, only 20 per cent of all trips are on the Muni. BART's ability to relieve peak period congestion and improve the quality of life for both users and non-users should not be underemphasized. With one-third of the out-commute work trips on BART, four less freeway lanes would be needed in 1990 than with no transit.

As an illustration of the theoretical maximum capability of BART to reduce automobile usage, assume that a new community and all of the land within walking distance of the four stations with the highest residential development potential were at population holding capacity in 1990, accommodating 63,000 persons. If these people made no automobile trips at all, and 10 per cent of the trips generated by other Valley residents were diverted to transit, the total number of vehicle trips would be 35 per cent less than with no transit.

GENERATION AND EVALUATION OF STATION AND ROUTE ALTERNATIVES

The process of selecting the best route for a BART extension involves multiple repetition of three steps. First, alternatives are generated; second, impacts are predicted; and third, impacts are evaluated and compared. The process of generation and evaluation is shown in the accompanying flow diagram. This report describes five cycles of the process. Table 5 shows the phases of evaluation.

Alternatives have been generated by both intuitive and systematic searches. Early in the study all corridor access routes to the Valley were identified and checked for engineering feasibility. Station locations to fit these routes and to serve areas of apparent high trip generation or attraction in the Valley were located. Additional possible station locations were determined by use of an accessibility model measuring population within eight minutes driving time of 72 Valley zone centroids. Impacts were measured as prescribed in the Evaluation Criteria Report to test compliance with planning objectives drawn from issues described in the Issues Report. Both of these reports have been revised following review by the Extension Board, the Citizens Committee, and the Technical Advisory Committee (TAC).

The impacts of the Valley stations were predicted and evaluated in Phase IA. The results were used as inputs to the next cycle during which alternative Valley routes were generated. Two new stations were added at that point and evaluated along with the routes in Phase IIA. The criteria used in evaluations dictated the number and type of impacts that would be predicted.

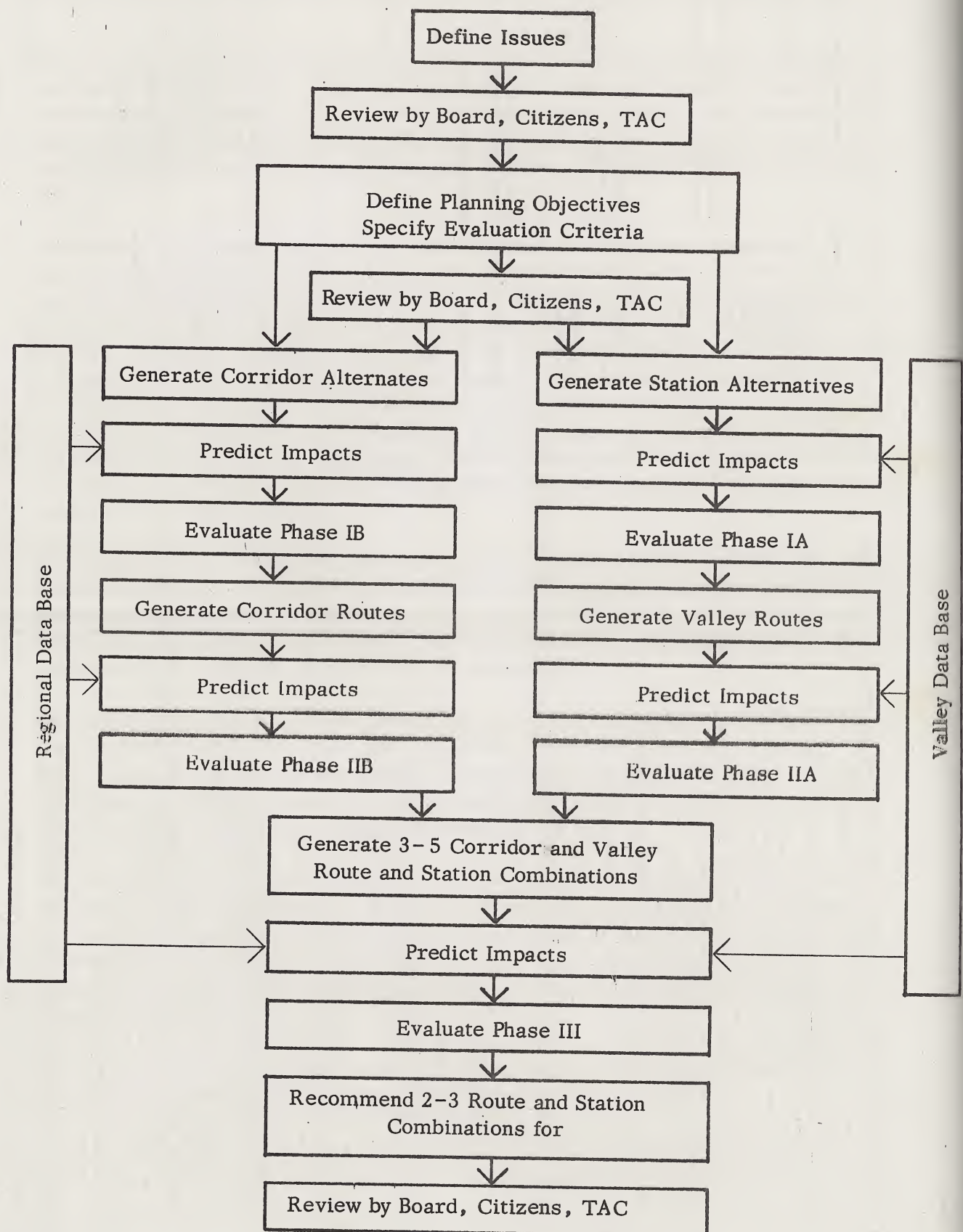
Concurrently the three corridors were defined, selected impacts predicted, and a preliminary evaluation, Phase IB, conducted. The next cycle for corridor studies then began with an elaboration of route alternatives within three corridors. The impacts of these routes were predicted for the Phase IIB evaluations. The Niles Canyon corridor was dropped following Phase IIB.

The results of IIA and IIB evaluations were the inputs for the generation of six preliminary line alternatives. Impacts of these alternatives that had not been previously evaluated were predicted, while previous predictions of impacts were re-evaluated. Progressive refinement of the impacts not only was possible with more data available but also was necessary in order to permit a finer differentiation among routes.

The process will be repeated for two or three routes during Phase IV and the results described in a Final Alternatives Report.

CRITERIA	Stations	Corridors	Routes	Corridors	Routes
1. OBJECTIVE: MINIMIZE BART CONSTRUCTION AND OPERATING COSTS.					
a. 1990 annual debt service and operating costs per passenger in 1972 dollars.					
b. Total cost in 1972 dollars of right of way, construction and equipment needed for operation.					
c. Comparison with bus system.					
2. OBJECTIVE: MAXIMIZE BART USAGE AT A GIVEN POPULATION LEVEL.					
a. Population potential within 1,500 feet of stations.					
b. Population 1980 within a one mile service area from stations.					
c. Population potential within one mile service area from stations in addition to criterion b.					
d. Accessibility of stations to 1980 population within 8 minutes driving time.					
e. Existing and definitely planned employment within 1,500 feet of stations.					
f. Projections of the Regional Transit Travel Projections Project (RTTPP).					
g. BART travel time for Valley patrons; comparison with alternate modes.					
h. Suitability to serve young, old, poor, and disabled.					
3. OBJECTIVE: MINIMIZE TOTAL DIRECT TRAVEL COSTS.					
a. Change in travel costs for trips diverted to BART.					
4. OBJECTIVE: AVOID CHANGE IN DEVELOPED RESIDENTIAL NEIGHBORHOODS.					
a. Proximity of stations to existing development.					
b. Propensity for change in neighborhoods near BART stations or routes.					
c. Line disruption.					
d. Traffic disruption.					
e. Station disruption.					
5. OBJECTIVE: MAXIMIZE ENVIRONMENTAL COMPATIBILITY.					
a. Noise levels.					
b. Visual and physical fit.					
c. Urban design potential.					
d. Air pollution.					
e. Disturbance of land forms, vegetation, waterways, wildlife.					
f. Geologic hazards.					
g. Historical sites; recreation areas.					
h. Energy requirements.					
6. OBJECTIVE: MINIMIZE INEQUITIES CREATED BY A BART EXTENSION.					
a. Displacement by characteristics of persons and businesses displaced.					
b. Increased travel cost for Valley employees displaced by housing cost increase.					
c. Loss of business.					
d. Increased travel by reason of neighborhood separation.					
7. OBJECTIVE: PRESERVE MAXIMUM OPEN SPACE.					
a. Population potential within 1,500 feet of stations.					
b. Population potential within one mile service area from stations.					
c. Total urban acreage versus a no-BART alternative.					
8. OBJECTIVE: MINIMIZE VALLEY POPULATION GROWTH.					
9. OBJECTIVE: DO NOT RESTRAIN VALLEY POPULATION GROWTH.					
a. Additional population growth induced by improved accessibility versus a no-BART alternative.					
10. OBJECTIVE: MAXIMIZE ECONOMIC DEVELOPMENT OF EXISTING CENTERS IN THE VALLEY.					
a. Net change in jobs in central districts.					
b. Net change in residential population in central districts.					
11. OBJECTIVE: MAXIMIZE ECONOMIC DEVELOPMENT AT POINT OF CONNECTION TO EXISTING BART LINE.					
a. Jobs projected in 1990 within one mile of extension terminal with and without extension.					
b. Net change in RTTPP projected attractions with extension.					
c. Development potential near extension terminal.					
12. OBJECTIVE: MINIMIZE LOCAL GOVERNMENT COSTS.					
a. Land area required for BART facilities.					
b. Savings resulting from compacting.					
c. Change in capital investment requirements.					
13. OBJECTIVE: MAXIMIZE COMPATIBILITY WITH EXISTING GENERAL PLANS.					
a. Degree of conflict with existing general plans.					
14. OBJECTIVE: MAXIMIZE COMPATIBILITY WITH EXISTING BART SYSTEM AND WITH OTHER POTENTIAL TRANSIT EXTENSIONS.					
a. Available capacity on existing BART lines.					
b. Compatibility with transfers to a bus system.					
c. Compatibility with transfers to a rail system.					

GENERATION AND EVALUATION OF STATION AND ROUTE ALTERNATIVES



BART CORRIDOR ALTERNATIVES

The potential regional development impact and patronage that would be attracted by BART lines in three corridors are described in earlier sections of this report. This section describes the physical and functional attributes of each and the reasons for rejections of several corridor alternates. The corridors are shown on the Alternate Routes map at the front of this report. Detailed descriptions of the routing of the six lines under study in two corridors are in Appendix A.

DUBLIN CANYON CORRIDOR

At the request of BART, the Division of Highways has included an 80 foot median in its plans for reconstruction of I-580 between Hayward and Dublin to an 8-lane freeway. The normal median width would be 30 feet. Forty feet of the median would be available for a BART line, but could be used for future additional freeway lanes, reversible express lanes or exclusive bus lanes if BART is not built. The Final Environmental Impact Statement for the route is now under consideration by the Department of Transportation. The existing highway through Dublin Canyon has caused severe disturbance of the natural terrain. The new freeway will require massive cuts and fills. A joint transportation corridor appears to be the only logical solution, even if a freeway narrower than the proposed 196 foot shoulder to shoulder section were to be built. Separate highway and BART rights of way would greatly increase environmental disruption, and use of the median offers an important potential cost saving to BART. The simplest connection to the existing Fremont Line would be via a transfer at Bay Fair Station. BART would follow the median of Highway 238 from the I-580 interchange to Ventry Way west of Mission Boulevard, dip under the westbound lanes and proceed along the east side of the existing BART track to Bay Fair. Preliminary studies have been made of three possible alternates:

1. Turning BART south into the existing Fremont Line north of Hayward.
2. Bringing BART from I-580 along Redwood Road on aerial structure to A Street and thence by Subway to the Hayward Station with a possible future extension west across the Bay.
3. Turning BART into the median of the proposed Route 92 Freeway (planned for construction after 2000) to a transfer station on the Fremont Line, a northward connection to the Fremont Line, or an extension across the Bay.

Castro Valley is the only potential station location in the corridor. Low cost, high patronage, and minimum community disruption as indicated by the evaluation make the Dublin Canyon corridor a strong contender.

SAN RAMON VALLEY CORRIDOR

Two existing transportation routes through the San Ramon Valley offer joint use opportunities that would minimize BART's impact on existing development.

South of Danville the S.P. right of way is 100 feet or wider and BART would be within the right of way at grade except where aerial structure would be necessary to allow spur tracks to serve the designated industrial area south of Crow Canyon Road. North of Danville 60 per cent of the S.P. right of way is 50 feet wide and the remainder is 100 feet wide. Local streets cross the tracks at intervals of about one-quarter mile and there are no north-south streets that could serve as frontage roads. Consequently, aerial structure would be required for BART. In the 50 foot sections about 20 feet of additional right of way would be needed for the structure. Therefore, a freeway alignment for BART north of Danville merits study.

The section of I-680 Freeway between Rudgear Road in Walnut Creek and Sycamore Valley Road in Danville was designed to provide initially 4 lanes and a 46-foot median with provision for future addition of 2 lanes in the median. The Division of Highways currently is preparing to widen this segment to 6 lanes by adding an additional lane on the outside of each roadway. If required in the future, an additional two lanes could be constructed within the existing 46-foot median, although the resulting 22-foot median width would be less than the current desirable minimum of 30 feet.

Several concepts for accommodating BART within the freeway have been explored. Since all of the grade separations along this section except Sycamore Valley Road are underpasses, the freeway could be widened to the outside, either to accommodate additional freeway lanes or BART, with a minimum of disruption to the existing structures. However, no widening beyond that required to provide 6 lanes could be accomplished entirely within the existing freeway right of way, particularly in areas where the existing ground is steeply sloped near the right of way line. In many areas, residential development abuts the right of way.

BART could not be placed at grade in the existing 46-foot median without widening the freeway since the resulting 3 foot horizontal clearance from the edge of the traveled way to the required 40-foot BART right of way would be inadequate. Therefore, placing BART at grade in the median would require widening the freeway from 34 to 58 feet, depending upon whether an allowance is made for future

widening from 6 to 8 lanes by adding two lanes in the median. Because of the extensive reconstruction and additional right of way required to implement this concept, it was tentatively abandoned.

The concept of placing BART on aerial structure in the existing 46-foot median without widening the freeway then was investigated. The resulting 17 feet of horizontal clearance from the edge of the existing roadway to the face of the crash barrier protecting the columns supporting the aerial structure probably would be adequate initially. However, it would not permit the Division of Highways to widen the freeway from 6 to 8 lanes by adding the additional two lanes in the median, since the resulting horizontal clearance of only 5 feet would be unacceptable.

Therefore, it is presently assumed that BART could be placed on aerial structure in the median. Other possibilities include placing BART on aerial structure on the side slopes adjacent to the freeway, or on cut or fill with retaining walls adjacent to the freeway.

Preliminary studies have been made of six possible alternatives for routing BART through Walnut Creek to a connection with the Concord Line. All involve considerable disruption.

1. The least disruptive alternate follows I-680 on aerial structure to the Walnut Creek Station. Reconstruction of the Walnut Creek Station and extensive widening of Oakland Boulevard between Trinity Avenue and Ygnacio Valley Road and North California Boulevard between Triangle Avenue and North Main Street would be necessary.
2. Aerial structure adjoining or over the S.P. tracks to Ygnacio Valley Road, then turning west to the existing BART track south of Pleasant Hill Station. The direct line connection would be to Concord.
3. Similar to Alternative 2, above, but with a tight U turn tying into the Concord Line just north of the Walnut Creek Station and allowing a direct connection to Oakland.
4. Aerial structure following I-680 to South Main Street and then branching west through residential areas to the existing BART line at El Curtola Boulevard.
5. Aerial structure and tunnels through residential areas at the edge of the hills crossing Olympic Boulevard near Tice Valley Road to a connection with the Concord Line east of the Pleasant Hill Road interchange in Lafayette.

6. Aerial structure leaving the Alternate 5 alignment near Tice Valley Road and proceeding west along Olympic Boulevard and north in tunnel to the Concord Line west of the Pleasant Hill Road interchange in Lafayette.

High right of way and structure costs and community disruption are negative aspects of the San Ramon corridor as indicated by the evaluations, although its adverse impact on the natural environment is less than in the Dublin Canyon corridor.

CORRIDOR ALTERNATIVES REJECTED

Rejected corridor alternates are shown as dotted lines on the Route Alternative map.

In the Niles Canyon corridor two alternatives were studied. A route in Niles Canyon follows the S.P. tracks where curvature meets BART standards, assuming that S.P. will relocate on the W.P. right of way. If the present S.P. tracks were to remain, 3.5 miles of additional aerial structure would be needed for BART. In both cases 3,300 feet of tunnel is required. An alternate following the I-680 Mission Pass route would require a three-mile BART tunnel under Mission Pass to meet BART grade standards and would cost \$55-\$75 million more than the Niles Canyon alignment. The travel time penalty for northbound trips would be 4.5 minutes compared to a Niles Canyon route.

Half a dozen possible alternatives for connection to the Fremont Line were studied, including two that would be feasible with a BART South Bay loop or a Dumbarton Crossing. For a majority of patrons who would have destinations north of Fremont, connection of a Niles Canyon line to the Fremont Station would require out of direction travel. More efficient connection points would be midway between the Fremont and Union City Stations.

If a Niles Canyon line were extended from the Fremont Station, it would be possible to provide through trains to the Valley without lengthening headways to Fremont. This would be an advantage over the transfer required at the connection point of a Dublin Canyon extension in order to avoid reducing headways south of Bay Fair. However, total travel times for Valley BART patrons headed north would be longer than with a Bay Fair transfer, and the problem of maintaining headways while serving the Valley with through trains would arise again if BART were extended south of Fremont to San Jose.

The cost of a Niles Canyon line to Livermore Station O is between \$195 and \$215 million. With only 59 per cent of the work trips carried by a Dublin Canyon line, the cost per passenger would be 50 per cent higher if the Niles Canyon corridor were selected.

Regional development issues related to the Niles Canyon corridor are discussed in the section of this report on Regional Development Impact of BART Service Corridors.

The 7.5 minute travel time penalty for trips to San Francisco or Oakland as compared with a Dublin Canyon line gives the Niles Canyon corridor a lower traveler benefit rating.

A serious drawback of the Niles Canyon corridor is its inability to provide good service to the Dublin-San Ramon area. The Pleasanton station on a Niles Canyon line to Livermore would be about four miles from the Dublin-Northwest Pleasanton stations on a Dublin Canyon or San Ramon line.

A preliminary environmental analysis indicates that a BART line in Niles Canyon would cause more environmental disruption than a line in the Dublin Canyon or San Ramon corridors. Both Niles and Dublin Canyons have problems of landslides, devegetation, and stream encroachment; but, in each instance, a Niles Canyon route probably is more difficult to negotiate. The two railroads and highway in Niles Canyon have caused relatively little disturbance due to careful horizontal alignment. In contrast, the curvature of a BART line would impose a substantially altered environment.

In summary, the Niles Canyon corridor was dropped from further consideration for the following reasons:

1. Low patronage.
2. High cost relative to patronage.
3. Longer travel times for most patrons.
4. Poor service to the Dublin-San Ramon area.
5. High environmental disruption.

A possible route through Crow Canyon north of I-580 was abandoned after brief investigation. Extensive tunneling would be necessary and the route is six miles longer than the Dublin Canyon lines. The only gain would be a modest improvement in service to the San Ramon area over a Dublin Canyon line, and Valley patrons would travel 7 minutes longer.

BART STATION ALTERNATIVES

Identification of possible station locations is the starting point for examination of alternatives because rail transit service exists only at stations. The best route is the one that links the best set of stations with minimum disruption and provides the greatest visual amenity for both non-riders and riders.

Stations are selected for ease of access, fit with the community, convenience to present and potential jobs and residential locations, and with regard for spacing on the BART line. Stations on the outlying sections of the present BART lines are spaced at 2 to 3 1/2 mile intervals. Each station added increases BART travel time by one minute and adds \$4.8 million to construction cost. Studies prepared for the Northern California Transit Demonstration Project in 1967 estimated that about 50 per cent of the patrons at the outlying stations on BART's existing lines will drive to BART and park. Even if stations are located near employment and where the maximum amount of housing can be developed within walking distance, all of the stations on a Valley extension line except a station at a new transit-oriented community are expected to be of the park-and-ride type requiring 9 to 20 (700-1,800 spaces) acres if all parking is on a single level.

Possible stations were identified in two ways. Those that might attract BART trips, such as downtown stations, were readily located. Other station locations were determined with the aid of a computer program that used the projected street network to compare relative accessibility of population to the centroids of each of the 72 Valley analysis zones. Zones with the highest indices of 1980 population divided by driving time were selected.

Initially, 49 potential station sites were identified in the Valley and three corridors. Early evaluations narrowed the field to 18 stations in the Valley, one in the Dublin Canyon corridor and 7 in the San Ramon corridor. Following is a description of the rationale for selection of the 20 stations on the six lines under study. Appendix A describes area and access requirements.

CORRIDOR STATIONS

Unlike Valley stations, corridor station locations were selected after route alignments because of the limited route location possibilities.

Dublin Canyon Corridor Station

BART would be in the median of rebuilt I-580 freeway. Castro Valley is the only existing or suitable location for urban development. A Castro Valley station would provide better BART access than the present Bay Fair station for about 60,000 persons in 1990. In 1970 13 per cent of Castro Valley's employed population worked in Oakland or San Francisco. The location tentatively selected at Redwood Road is on the community's principal north-south thoroughfare and is the only point of convenient access from both sides of the freeway. However, the 12 acres required for a station (7 acres with decked parking) would take some improved property and would increase traffic at Redwood Road and Castro Valley Boulevard, the center of the community's commercial area. Alternate possible sites to the east and west merit further study.

San Ramon Corridor Stations

Projected continuous urban development along the 16 mile stretch from Walnut Creek to Dublin justifies three stations at an average interval of 4 miles serving a total 1990 tributary population of 71,000. From Danville north, dual sets of stations were studied to accommodate a BART line along either the railroad or the freeway.

Both of the South Walnut Creek alternate station sites are in low density single family residential areas and would require acquisition of improved property to provide the needed 9 acre site. These stations are too far south of downtown Walnut Creek to serve any employment destinations and they would have a low walk-to-ride potential because of the established low density housing pattern. About 21 per cent of the employed persons in the tributary area, which has a population of 29,000, commute to Oakland or San Francisco.

A station at Alamo, two miles south of the South Walnut Creek station sites, would be an alternate if BART were located along the S.P. tracks. The site is largely vacant and is zoned for single family residential development but adjoins retail commercial zoning. Site area would be 9 acres. Tributary population projected for 1990 is 14,300. Current commute to Oakland and San Francisco is 23 per cent. Selection of the Alamo station instead of South Walnut Creek would divert some patronage to the existing Walnut Creek or Lafayette stations because riders living north of Alamo would be reluctant to travel out of direction.

The Danville North Station on the S.P. route adjoins the business district on one side and a single family residential area on the other. Either acquisition of commercial buildings or a parking structure would be necessary. The Danville South Station at Sycamore Valley Road east of the S.P. tracks would serve the BART alignment following I-680 to the north. Creation of a 9 acre station site would require acquisition of about 20 homes in a developed single family residential area. The Danville stations would serve a 1990 tributary population of 20,000. At present 17 per cent of the employed residents commute to Oakland or San Francisco.

The San Ramon station would be on vacant land adjoining the S.P. tracks just south of Crow Canyon Road near the center of a large industrial area designated by the San Ramon General Plan. Several nuclear physics industries are located nearby. Projected 1990 tributary population is 22,000. The current share of Oakland and San Francisco commuters is 28 per cent.

VALLEY STATIONS

Dublin-Northwest Pleasanton Stations

Four sites with widely varying characteristics were studied, two north of I-580 and two to the south. If the Dublin Canyon corridor were selected, the one station in this area would draw from an area with a 1990 high population of 103,000 extending north to the south edge of Danville and ease of access from this direction would be particularly important. With a San Ramon station tributary population would be 81,000. Current Oakland-San Francisco commute is 22 per cent.

Station A adjoining the S.P. tracks at Dougherty Road opposite Camp Parks will be strongly affected by the future development of the Camp Parks site which is in process of disposition by the General Services Administration without benefit of a development plan. A proposed federal prison one mile northeast is likely to preclude residential development near the station. Industry is the most probable surrounding use.

Station B across from the K Mart on Dublin Boulevard in a mixed commercial-industrial area would attract some patronage from nearby employees, but would serve no walk-to-ride commuters. Stations A and B would be more accessible to San Ramon Village residents than their alternates south of the freeway, but for trips originating north of the Contra Costa County line the prospective I-680 interchange at Stoneridge Drive and the lack of any interchange between Alcosta Boulevard and I-580 make driving time less to Stations D and E.

Station D would adjoin a high density residential area on the south and a proposed five department store, 1.5 million square foot regional shopping center to the north. Both the shopping center and the BART station are dependent on convincing the State to build an interchange or at least an overcrossing at I-680 and Stoneridge Drive.

There are both major benefits and disbenefits to locating a BART station at a regional shopping center. BART now has two, Bay Fair and El Cerrito Plaza, that may provide an indication of the degree of compatibility. Obviously there are potential parking conflicts and evening peak hour traffic conflicts. The type of shopping center planned, and the amount of land controlled by the Stoneridge developers make it probable that this site will be the business center of the Valley, attracting substantial office employment. The developer's estimate of 8,000 jobs would offer BART the largest in-commute potential of any extension station even if only half this number were within walking distance. Of the 30,000 average daily shoppers expected at the center in 1990, only 375-525 are projected as BART patrons. In addition to functioning as the park-and-ride station for the Dublin-North Pleasanton area, D probably would have its full 2,700 walk-to-ride population holding capacity developed before any other station. The question is whether congestion at Station D would hamper the multiple functions it would be designed to perform.

Station E west of Hopyard Road on Stoneridge Drive would be on open land adjoining a single family residential tract to the south (Valle Vista). The site currently is designated for industrial use, but logically could be changed to allow residential development of all land within walking distance of the station without adversely affecting existing industrial development.

Pleasanton Stations

The five sites studied include two on open land near Santa Rita Road, two in old Pleasanton, and one in between. Tributary high population in 1990 is 59,000. Present Oakland-San Francisco commute is 15 per cent.

Station F on Las Positas Boulevard west of Santa Rita Road is on land designated for industry, but the area within walking distance could become a logical extension of existing residential development to the south and east. The site is within walking distance of the proposed new 400 bed (1990) acute hospital planned by the Valley Memorial Hospital as the major health care facility in the Valley.

The hospital would generate about 750 daily BART trips in 1990. If the hospital project proceeds, the area between the station and the hospital site to the north is likely to be developed with medical buildings.

Station G south of Arroyo Mocho and the Fairlands subdivision east of Santa Rita Road is on open land and could accomodate maximum walk-to-ride development on three sides. Access would be mainly from Santa Rita Road.

Station H adjoining the S.P. tracks at Radum is surrounded by gravel pits that are likely to be reclaimed only for industrial use because of the proximity of gravel processing equipment. Access would be via Valley Avenue extension as proposed by the Pleasanton General Plan, and there is some potential for walk-to-ride development north of Valley Avenue. Because Station H is well to the east of the centroid of Pleasanton population, some patrons who would use the other possible Pleasanton stations would use the Dublin-Northwest Pleasanton station instead.

Station J on Bernal Avenue opposite the Alameda County Fairgrounds would have no walk-to-ride population assuming the San Francisco Water Department lands south of Bernal Avenue are developed for industrial use as planned. However, this site has the highest accessibility rating of all Pleasanton station alternates. Increasing year-round use of the Fairgrounds and proposed additional facilities would generate about 175 BART trips per typical day. During the 15-25 days per year when the fair or other events draw large crowds from the entire county, this station would markedly decrease congestion in Pleasanton.

Station I along the S.P. tracks between Ray Street and Arroyo Valle would put nearly all of downtown Pleasanton within walking distance. The question is whether the benefits of additional retail and office development that might be generated are offset by the disruption that the 20 acre station (4-11 acres with multi-level parking) would cause and the comparatively poor walk-to-ride potential resulting from present full development of the surrounding area at predominantly single family density. This station provides by far the best service to the elderly and disadvantaged of any Pleasanton station.

Livermore Stations

The most easterly Livermore station is envisioned as the terminus and yard station common to all lines except a K-P extension. The other three alternative

locations include one downtown site and two near the edge of existing development. Tributary high population in 1990 is 52,000 (excluding the new community). Current Oakland-San Francisco commute is 5 per cent.

Station K is an abandoned gravel pit north of Portola Avenue is bordered by open land on the north and east. It occupies an intercepting position for most Livermore traffic to I-580 westbound, but its peripheral location increases average trip length for present residents.

Station L at Murietta Boulevard adjoining the W.P. depends for satisfactory access on the S.P. being relocated to the W.P. right of way. The first phase of this project currently is in the final design stage. Although this site has only moderate walk-to-ride potential, it has the second best accessibility rating of Livermore stations studied.

Station M on the W.P. tracks (with S.P. consolidated) between L Street and North Livermore Avenue is within 1,500 foot walking distance of much of downtown Livermore although it is 1,100 feet from First Street. The advantages and disadvantages are similar to those of a downtown Pleasanton station except that the scale of Livermore and the more dispersed pattern of existing development make the 9 acre station site with at grade parking less disruptive. The location near the center of the city gives M the highest accessibility rating among Livermore stations.

Station O would adjoin the W.P. tracks on an extension of Mines Road proposed by the Livermore General Plan. The area is designated for light industrial use and the Hexcel plant is just west of the station site. Station O would serve the eastern portion of Livermore and the Springtown area north of I-580 if BART is not extended to Station P. A BART yard east of the station would be compatible with proposed industrial development in the area.

Station P

The possible new transit-oriented community north of I-580 (discussed under Role of BART in Valley Development Alternatives) would be served by Station P. The only location requirement for Station P is that it be near the center of 3 to 4 square miles of vacant developable land that can be brought under unified control. The cost of a BART extension to Station P would be \$31 million, or \$900 for each prospective resident of the new community.

STATION LOCATIONS REJECTED

Most station locations studied and rejected could be served only by lines that were rejected, and the station functions were readily transferred to an alternate site. Two rejected station sites merit discussion.

A station serving the Livermore Radiation Laboratory and Sandia Corporation might seem essential because this is the Valley's largest existing employment concentration with over 6,500 jobs. However, 58 per cent of the employees are Livermore residents and therefore not likely BART patrons. A 1971 survey showed 10 per cent of LRL-Sandia employees living in the West Valley and 32 per cent living out of the Valley. An estimated 30 per cent live in areas potentially served by BART (assuming BART or express bus in all three corridors). Using the RTTPP projection that BART will serve 15 to 20 per cent of work trips attracted, an LRL station would serve 400 employees, or 800 daily trips. Even with addition of a few outbound commuters (nearly all of whom would have to travel out of direction to the station), extension of two miles of line to the Radiation Laboratory and construction of a station at a total cost of \$20 million (or \$50,000 per employee using BART) does not appear justified. New industrial employment east of Vasco Road is not likely to add many jobs within walking distance of a BART station.

Enrollment at the South County Junior College District campus site on Collier Canyon Road north of I-580 is expected to reach 3,400 to 4,500 students by 1990. Experience at similarly situated junior colleges in the Bay Area suggests that about 30 per cent of the trips will be by transit. Assuming BART would not serve Livermore trips, it could handle 60 per cent of the transit trips or up to 1,600 trips per day. This would justify a station if there were additional development potential and if the location were compatible with other stations and route links. The Alameda County Open Space Plan calls for retaining all of the area around the junior college as permanent open space, while the Livermore General Plan proposes residential development from the site east. In either case, the station would not be well located to serve trips other than those related to the college. The only BART route alignment that could serve the college without difficulty is along I-580 (see Valley Links Rejected). A college BART station would be only 1.2 miles from Station K, but could not be substituted for K and would not be compatible with other Livermore stations except O. Provision of BART service to the college would require two freeway crossings and would add a BART cost premium of \$13 million, including the additional station. The value of the presently undeveloped site is about \$1 million. Relocation of the college would be preferable to attempting to bring BART to the present site.

BART VALLEY LINK ALTERNATIVES

Once stations were located, eleven links following existing rights of way or extending through open, undeveloped land were chosen. Five connect Dublin-Northwest Pleasanton stations with Pleasanton stations, four connect Pleasanton stations with Livermore stations and two extend to Station P. Through these links eleven possible routes exist without the new community extension, and fourteen with the new community extension. The Alternate Routes map shows all links.

Dublin-Pleasanton Links

Three of the links, D-E-F, B-F, and A-F would preclude service to downtown Pleasanton. They connect Dublin, Northwest Pleasanton stations with a North Valley corridor or a South Valley corridor that only serves downtown Livermore. Links B-F and A-F take advantage of the existing S.P. right of way running south from Dublin under I-580 to Las Positas Boulevard. Link D-E-F crosses over I-580 near Stoneridge Drive and extends east beyond Hopyard Road at grade to Las Positas Boulevard. The other two links, B-J-I and D-J-I, permit service to downtown Pleasanton. Each link follows I-680 at grade to Bernal Avenue and then continues on aerial structure along Bernal Avenue east to the S.P. right of way. BART structures generally are elevated within existing railroad rights of way and alongside major streets, and at grade alongside freeways and in open land. Major street crossings are on aerial structure.

Pleasanton-Livermore Links

Links between Pleasanton stations and Livermore stations follow three corridors. In a South Valley corridor links I-L-M-O and F-H-L-M-O parallel the railroad tracks along Stanley Boulevard into downtown Livermore and thence east alongside the W.P. tracks to the yard located beyond Station O. The lines are elevated alongside the gravel pits but are at grade between them and the fringe of Livermore. In the North Valley corridor the F-G-K-O link by-passes downtown Livermore, running at grade along the Arroyo Mocho and the proposed extension of Las Positas Boulevard. East of the Livermore airport it turns northeast, crosses over Portola Avenue and continues on aerial structure along Portola Avenue to First Street. After crossing over First Street the link continues on the north side of the W.P. tracks on aerial structure to Station O and then to the BART yard.

An alternate to the South Valley for the F-H-L-M-O link is the F-G-L-M-O link that follows the North Valley corridor to the southwest corner of the Livermore Airport where it turns southeast and joins the South Valley corridor west of

Livermore. Between F and L this link costs \$10.5 million less than the South Valley link because more of it can be built at grade. On both link alternates the travel time between F and L is identical

If Station H will provide better service than Station F or Station G, these traveler benefits will have to be weighed against the 25 per cent additional cost of construction. Trade-offs like this will be evaluated in greater detail in the next phase of study.

Livermore-Station P Links

Link K-P and link O-P extend to the new town site served by Station P. These links will be built at grade except for aerial crossings at major streets and over I-580. In an evaluation of the merits of these alternates the importance of Station O as a Livermore station and the timing of a new community development plan will be considered. Link K-O-P costs \$17 million more for construction alone than link K-P and has a 2.3 minute longer travel time from K to P.

Valley Links Rejected

Early studies included a line from the Dublin Canyon corridor remaining in the I-580 median to Portola Avenue in Livermore and Station K. There would be sufficient space for BART on an aerial structure in the median of the recently widened 8-lane freeway, but BART would have to go over existing interchange structures. If BART were to be at grade, the freeway would have to be widened by 50 feet and five or six overpasses reconstructed. The structural difficulties, combined with poor accessibility of stations at the edge of populated areas and the undesirability of attempting to maximize walk-to-ride population for stations in the freeway median led to abandonment of this link.

In Livermore brief consideration was given to a link branching southeast along the Arroyo Mocho in the vicinity of Station L and heading east across the vineyards to the Radiation Laboratory on a line midway between East Avenue and Tesla Road. This link was rejected because of its extreme disruption of the vineyards and the low warrant for a Radiation Laboratory station.

STATION TRADE-OFFS

The assignment of Valley stations to lines was arbitrary, station spacing and service to the three major population centers being principal criteria for station selection. In this way all stations judged feasible in the initial phases of evaluation are studied in Phase III. However, some of these stations are weaker than others in the evaluation of certain planning objectives. On each line several station trade-offs exist which could affect the rankings of line segments in the Valley. To illustrate this, five trade-offs among stations are discussed here: D replacing E, G replacing F, F replacing H, I replacing J, and M replacing L. The objectives which these station trade-offs significantly affect are 2: Maximize BART usage, 4: Avoid change in presently developed residential neighborhoods, 5: Maximize environmental compatibility, and 6: Minimize inequities created by a BART extension.

The first Valley station on the Green Line could be Station D in the regional shopping center instead of Station E located east of I-680. At Station D the population within one mile and the population potential are 15 per cent and 50 per cent lower, but the additional population potential within one mile beyond 1980 at D (Criterion 2c.) is five times that at E, and the 1990 planned employment within 1,500 feet is 4,000 as opposed to only 900 around Station E. The accessibility to 1980 population is 40 per cent lower at Station D. Greater patronage might be expected at Station D because of the higher employment and opportunities for high density development, attractive for BART commuters wishing to walk to Station D. The station would not serve the Dublin-North Pleasanton area as well as Station E. Service to the young, old, poor and disabled remains unchanged.

Community impacts at D are not quite as favorable as at E, with increases in propensity for change in nearby residential neighborhoods and in station disruption. On the other hand, the visual and physical fit and the urban design potential at Station D are superior to that at Station E. Substitution of Station D for E results in mixed gains and losses. More detailed evaluations will be necessary to resolve the conflicts and choose the superior station.

On the Red Line and the Brown Line Station G could replace Station F. In this trade-off seven criteria show significant improvement, four have lower evaluations, and four are unchanged. For Objective 2: Maximize BART usage, population potential within 1,500 feet increases by 20 per cent, 1980 population within one mile by 28 per cent, and accessibility by 60 per cent. Existing employment shows a slight gain while 1990 employment drops significantly since Station G does not adequately serve the planned regional hospital

and a proposed Johnson and Johnson manufacturing plant north of F. Service to the young, old, poor, and disabled remains unchanged. Although G is superior to F in four of the five measures of potential usage, these indicators may exaggerate differences in actual patronage at two nearby stations. Loss of hospital-bound trips if Station G is selected may tip the balance in favor of F.

For community impacts Station G is favored. This station will cause less change in developed residential neighborhoods. It is further from existing development and the propensity for change in their surrounding neighborhood is lower. Traffic disruption is slightly greater, but station disruption is equal at both stations. The visual and physical fit is higher at G but the urban design potential is lower. Finally, the displacement at both stations is minimal.

On the Brown Line substitution of Station F for H would result in lower traveler benefits and more favorable community impacts. For Objective 2: Maximize BART usage, the only evaluations that improve are population potential within 1,500 feet and 1990 employment. The increase in these measures is far less than the decrease in all other measures of evaluation, supporting the conclusion that station F is inferior to H for traveler benefits. The improved community impacts include less traffic and station disruption, and greater urban design potential. Station F is also further from existing development, but the propensity for change in the neighborhood around F significantly exceeds that around H. Replacing H with F does not change evaluations of displacement and visual and physical fit.

In Pleasanton substituting Station I for Station J on the Orange Line improves traveler benefits but causes greater displacement and neighborhood disruption. More population and employment will be located around Station I than around Station J. Accessibility to 1980 population is slightly less at I than at J, but the population potential within one mile is 60 per cent greater. Patronage at I probably would be higher than at J.

However, the change in presently developed residential neighborhoods will be much greater at Station I than at J. All measures for this objective indicate more disruption and neighborhood change would occur with Station I. The displacement at Station I is ranked F while at Station J it is B. The redeeming factors are that Station I has improved visual and physical fit and greater urban design potential, but these may not override the adverse community impacts of a downtown station location in Pleasanton. Further evaluations of the impacts of Station I and J will be made in the next phase to differentiate these stations.

In Livermore a similar trade-off exists between a downtown Station M and an outlying Station L. Overall evaluations of the Green and Brown Lines are affected if Station M replaces L. With M, traveler benefits measured by six of the seven criteria improve more than in any other trade-off previously discussed. Only the 1980 population within one mile declines and that is by less than two per cent. As in Pleasanton this improvement in traveler benefits must be judged against the increase in disruption and in potential change in neighborhoods surrounding Station M. No measure for either Objective 4: Avoid change in presently developed residential neighborhoods or Objective 6: Minimize inequities created by a BART extension favors M over L. Station M has only slightly better urban design potential and no better visual and physical fit. In contrast to the major advantage of I over J, the choice between L and M is more difficult to make and the need for additional evaluations of impacts is apparent. The development of detailed economic studies and schematic site plans in Phase IV as well as the refinement of previous evaluations should clarify the choice between these two stations. For all of these trade-offs it appears that additional traveler benefits can only be gained by sacrificing environmental values and accepting greater adverse community impacts.

SUMMARY DESCRIPTIONS OF SIX BART LINES

The six lines evaluated in the following section of this report traverse two corridors and three Valley routes. All lines have four Valley stations with a possible extension to a fifth station. Dublin Canyon lines have one corridor station and San Ramon lines have three corridor stations. Several possible alternate combinations of stations and lines are listed. Summary descriptions in this section are supplemented by detailed descriptions in Appendix A.

The Blue Line (Dublin Canyon-South Valley) provides maximum service to existing and proposed commercial centers, serving downtown Livermore and Pleasanton and the proposed Stonegate regional shopping center. Stations are Castro Valley, Northwest Pleasanton (D), Pleasanton (I), and Livermore (M and O).

The Red Line (Dublin Canyon-North Valley) avoids intensively developed areas, crossing the Valley between the gravel pits and I-580, and skirting the north side of Livermore. Stations are Castro Valley, Dublin (B), Pleasanton (F), and Livermore (K and O).

The Green Line (Dublin Canyon-North Valley-Downtown Livermore) parallels I-580 about .6 mile to the south and then curves further south to enter downtown Livermore. Stations are Castro Valley, Northwest Pleasanton (E), Pleasanton (G), and Livermore (L and O).

The Yellow Line (San Ramon-North Valley) parallels I-680 to South Walnut Creek, then borders the S.P. tracks south to I-580, and follows the Red Line to Livermore. Stations are South Walnut Creek (West), Danville (North), San Ramon, Dublin (A), Pleasanton (G), and Livermore (K and O).

The Orange Line (San Ramon-South Valley) follows the Yellow Line along the SP tracks south to Dublin, but then branches south through downtown Pleasanton serving the Fairgrounds, and east to downtown Livermore. Stations are Alamo, Danville (North), San Ramon, Dublin (B), Pleasanton (J), and Livermore (M and O).

The Brown Line (San Ramon-South Valley) extends from the Concord Line along I-680 to Danville and then parallels the S.P. track to downtown Livermore. Stations are South Walnut Creek (East), Danville (South), and San Ramon, Dublin (A), Pleasanton (H), and Livermore (L and O).

Five pairs of stations are interchangeable on certain lines.

Northwest Pleasanton D and E on the Green Line.

Pleasanton J and I on the Blue and Orange Lines.

Livermore L and M on the Blue, Green, Orange, and Brown Lines.

Pleasanton F and H on the Brown Line.

Pleasanton F and G on the Red, Green, and Yellow Lines.

Alamo and South Walnut Creek (West) on the Yellow and Orange Lines.

All lines could be extended to Station P at the new community site.

Several possible line variations are obvious.

The Green Line could follow the Red Line alignment through Livermore.

The Red and Yellow and Brown Lines could follow the Green Line alignment through Livermore.

The Red, Green and Yellow Lines could follow the Brown Line from Santa Rita Road to Livermore.

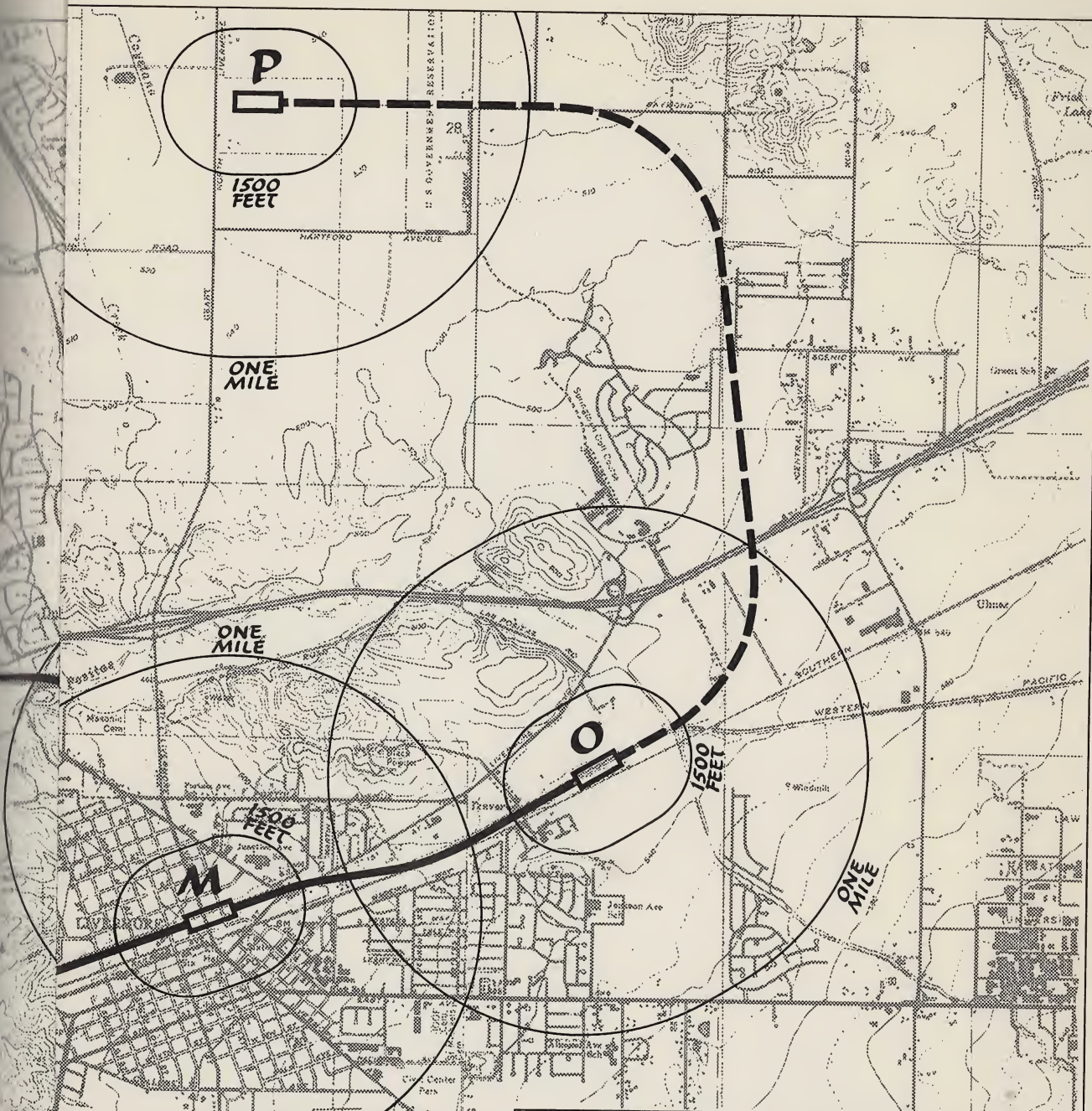
EVALUATIONS OF LINES

Six alternatives are evaluated for 9 planning objectives using 27 evaluation criteria. The process of evaluation presented in this report is the culmination of five phases of evaluation, described previously in the Evaluation Criteria Report. The phases of evaluation and the criteria measured in each phase are summarized in Table 5. In the first two phases, Phase IA and IB, Valley stations and 3 access corridors were evaluated separately, and in the next two phases, Phase IIA and IIB, Valley routes and access corridors were evaluated. These sets of evaluations were combined and six lines developed for evaluation in Phase III. The summary evaluations are presented here under four major categories:

- Growth
- BART costs
- Traveler Benefits
- Community Impacts
 - Urban Environment
 - Natural Environment

In each category the measures of evaluation for the criteria and the objectives are summarized and the lines ranked for each objective. The differences between the two corridors are then evaluated separately to show to what extent they influence the overall line evaluations. San Ramon corridor lines include seven stations, while Dublin Canyon corridor lines include only five. The impact of alternative stations and line combinations on the overall evaluations is discussed. All possible station locations judged feasible in earlier phases have been included in these preliminary evaluations. In the summaries for each of the four major categories one line or several lines are recommended for further study based on the outcome of the preliminary evaluations.

Three value scales are used. First is the scale of ordinal values for relative ranking of data. The second, interval scale defines the order and relative magnitude of difference between data items with an arbitrary origin. Use of a non-arbitrary origin transforms this scale into a ratio scale. For example, noise is measured on an interval scale and distance, time and money on a ratio scale.



Livermore-Pleasanton BART Extension

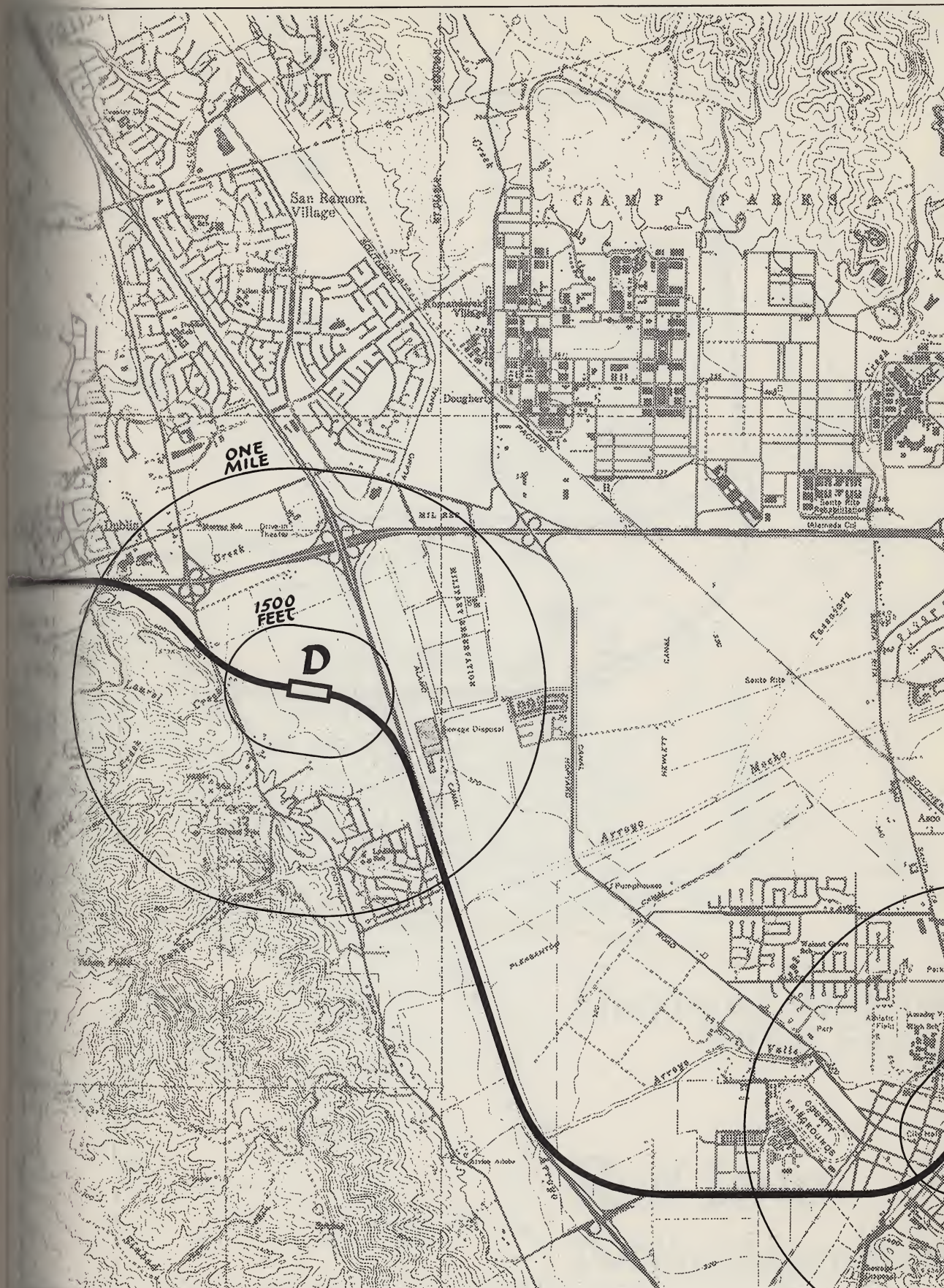
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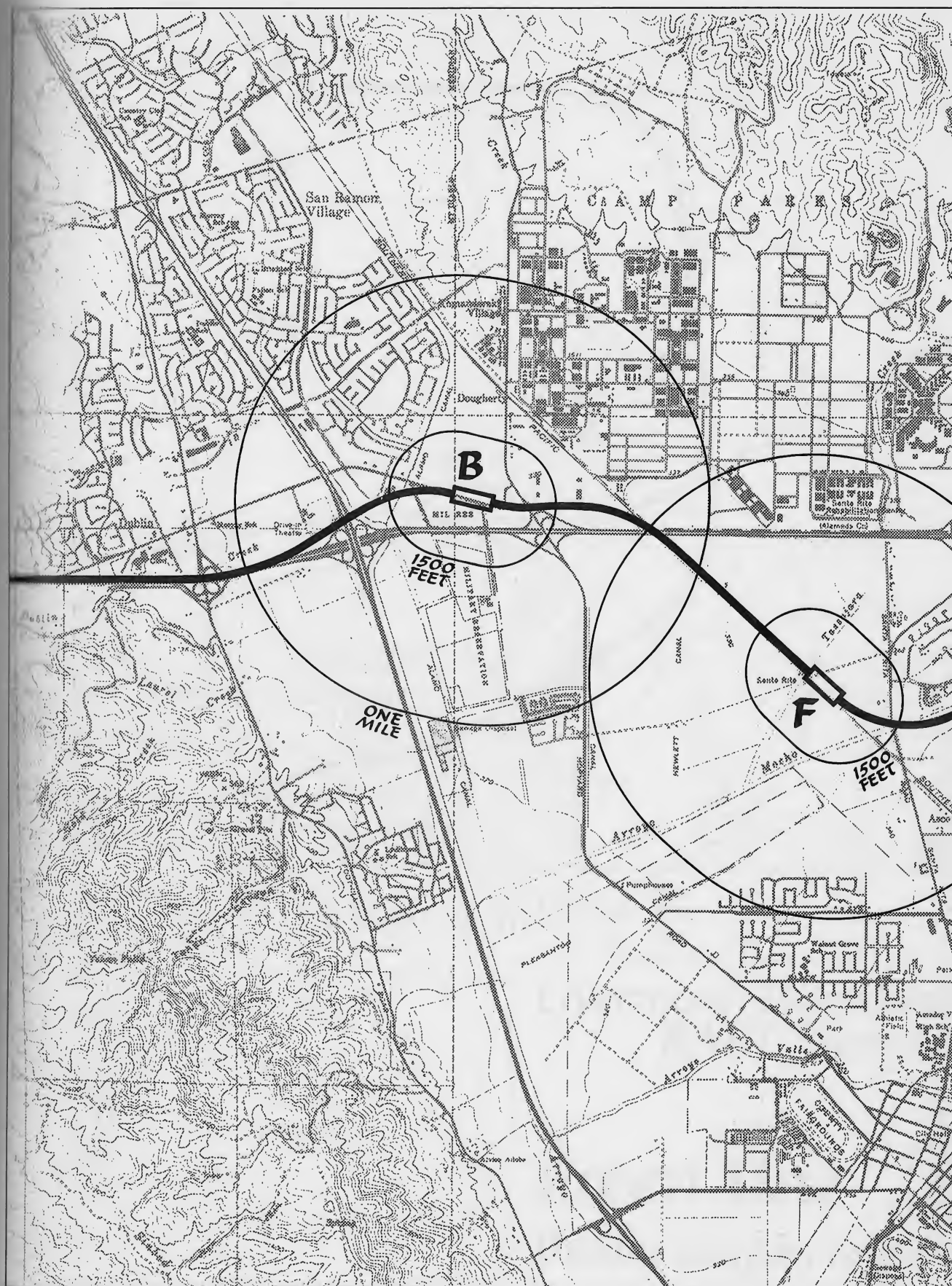




Livermore-Pleasanton BART Extension

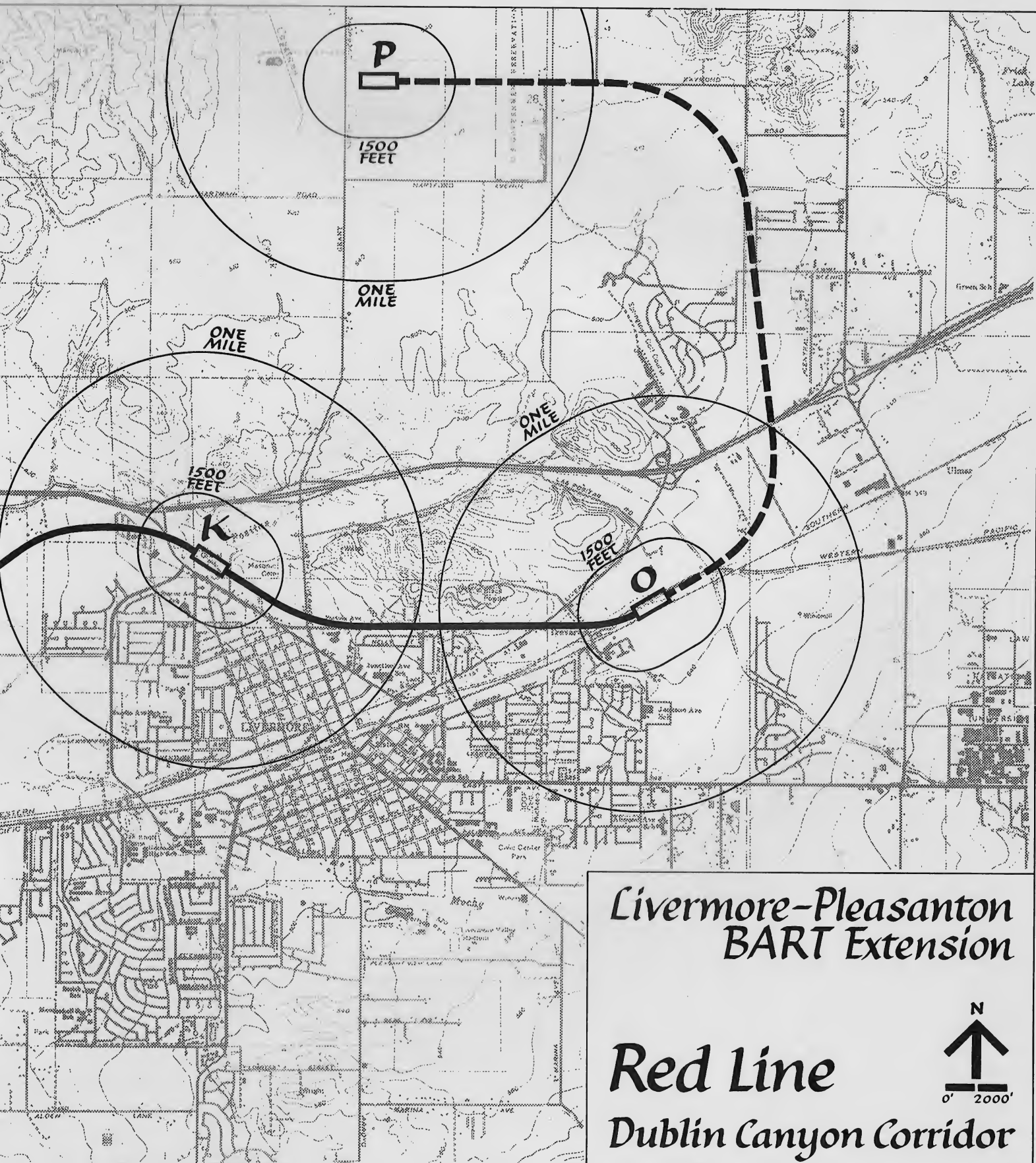
Blue Line
Dublin Canyon Corridor

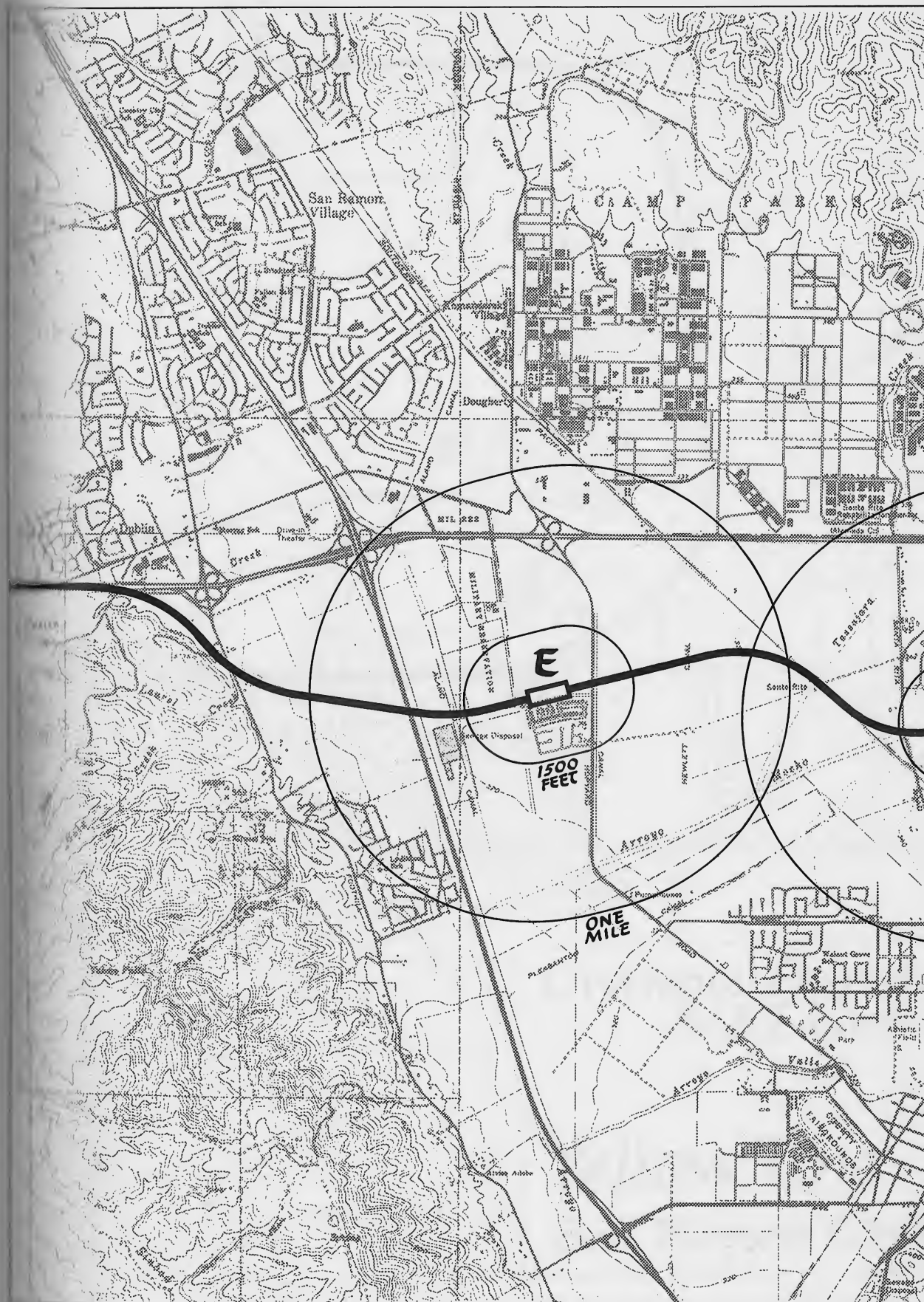
















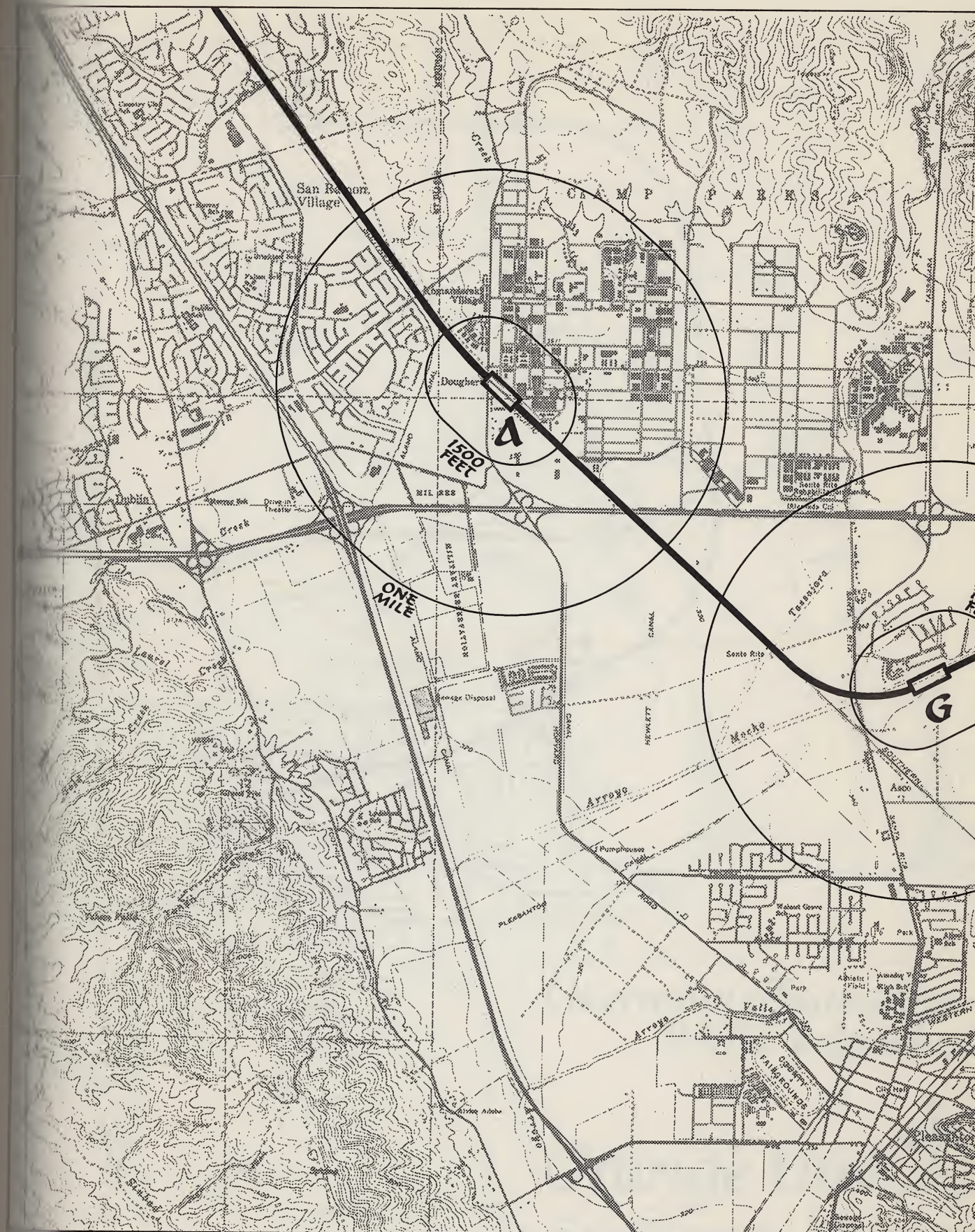


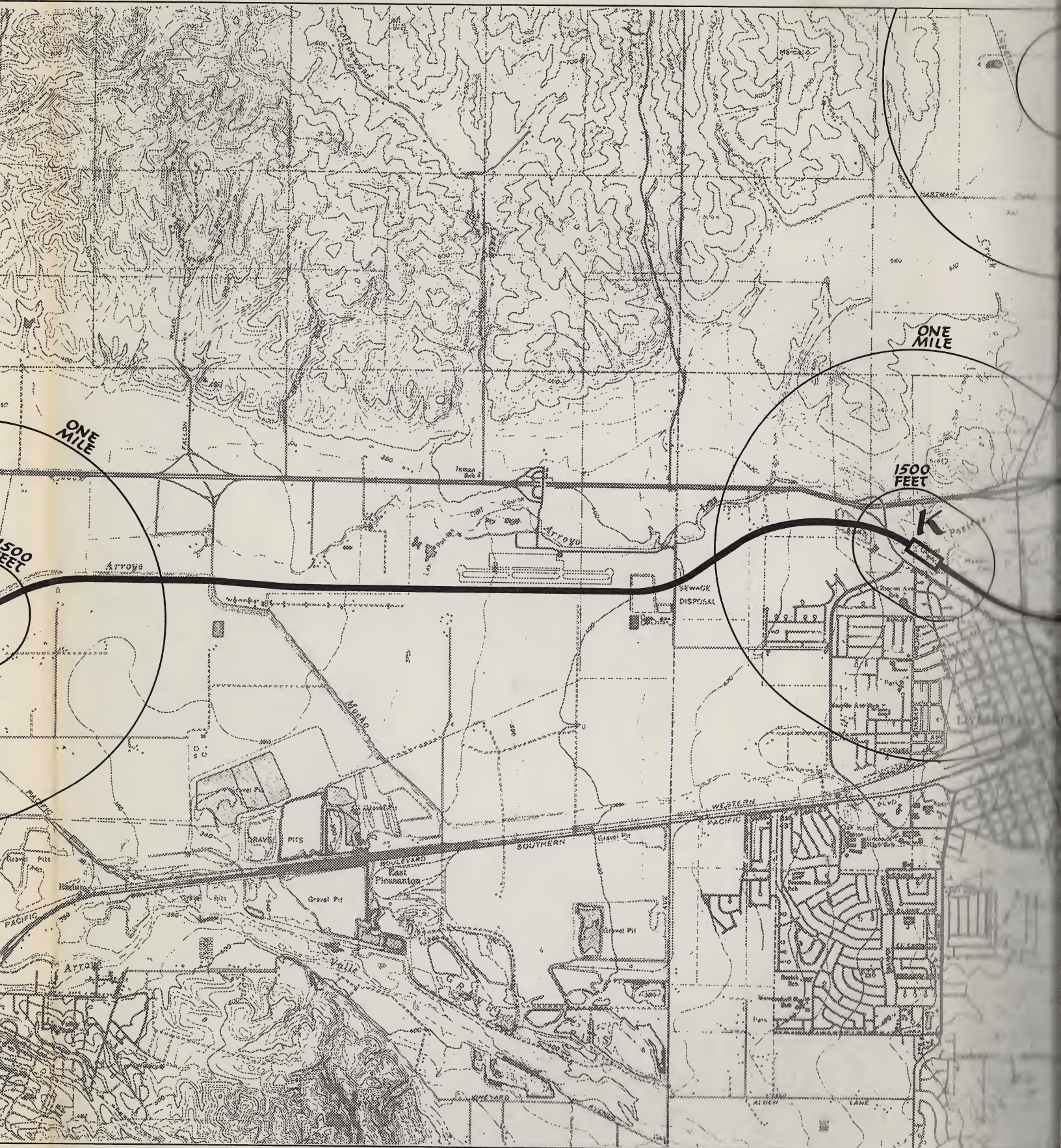
**Livermore-Pleasanton
BART Extension**

Green Line

Dublin Canyon Corridor





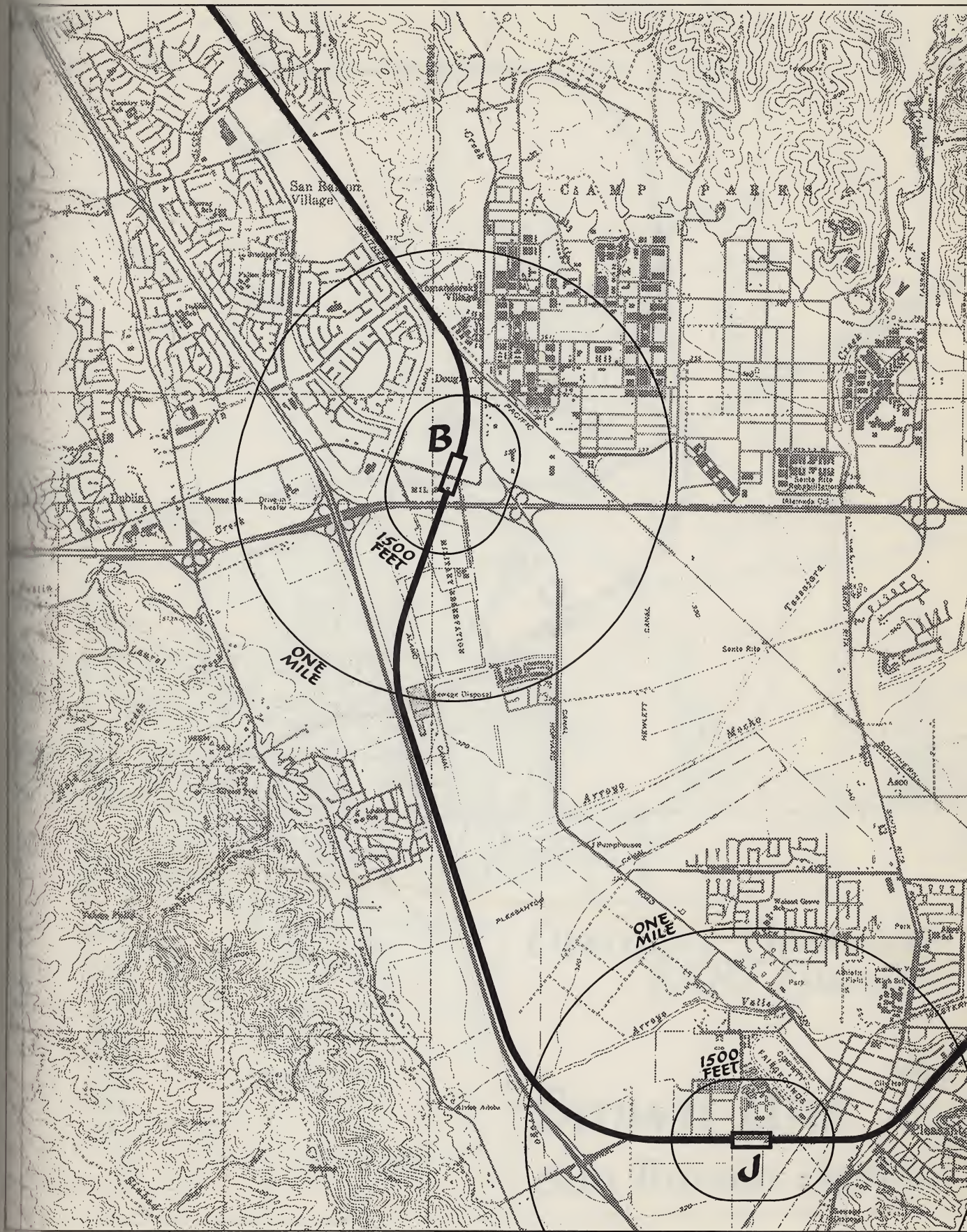






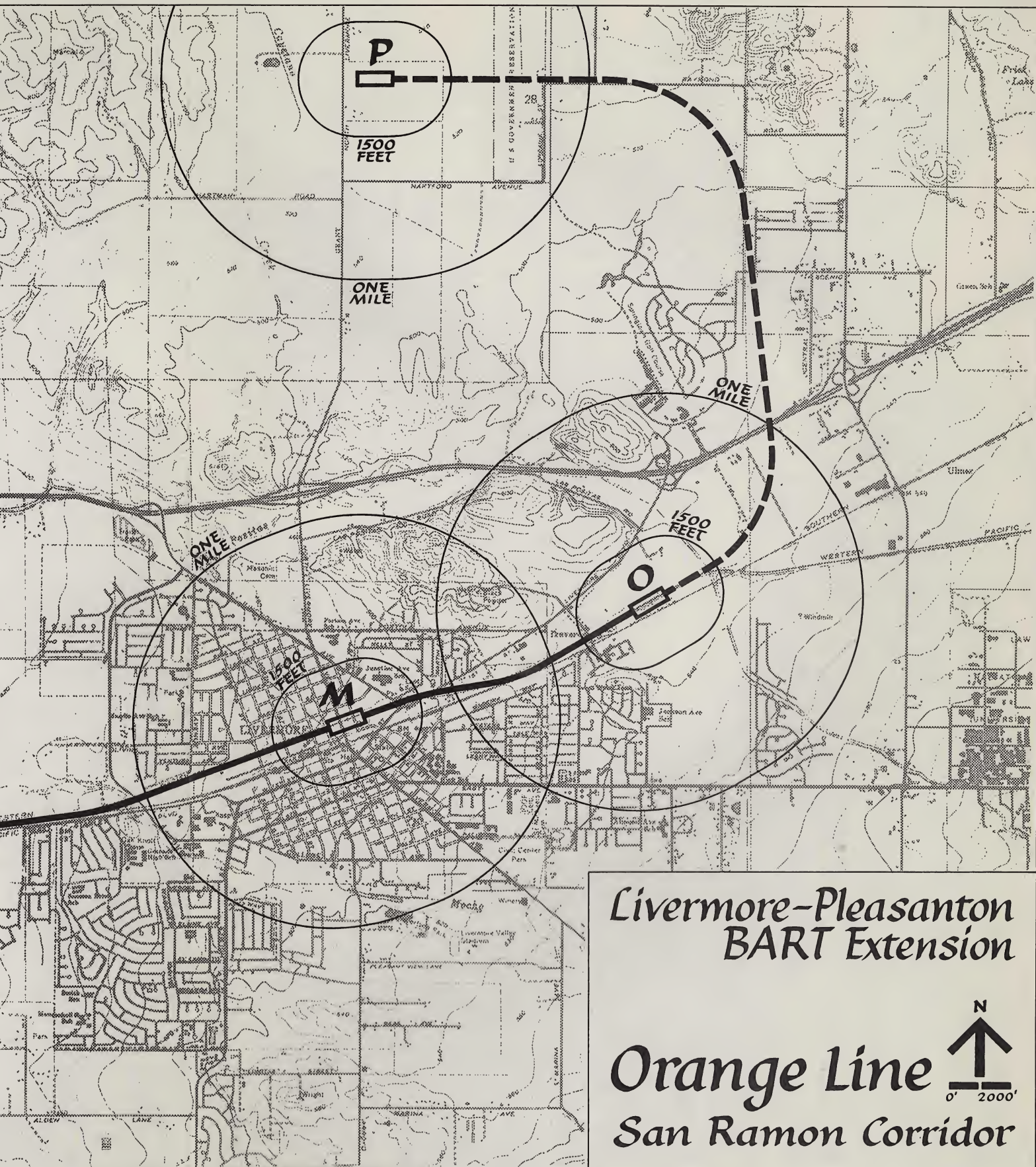






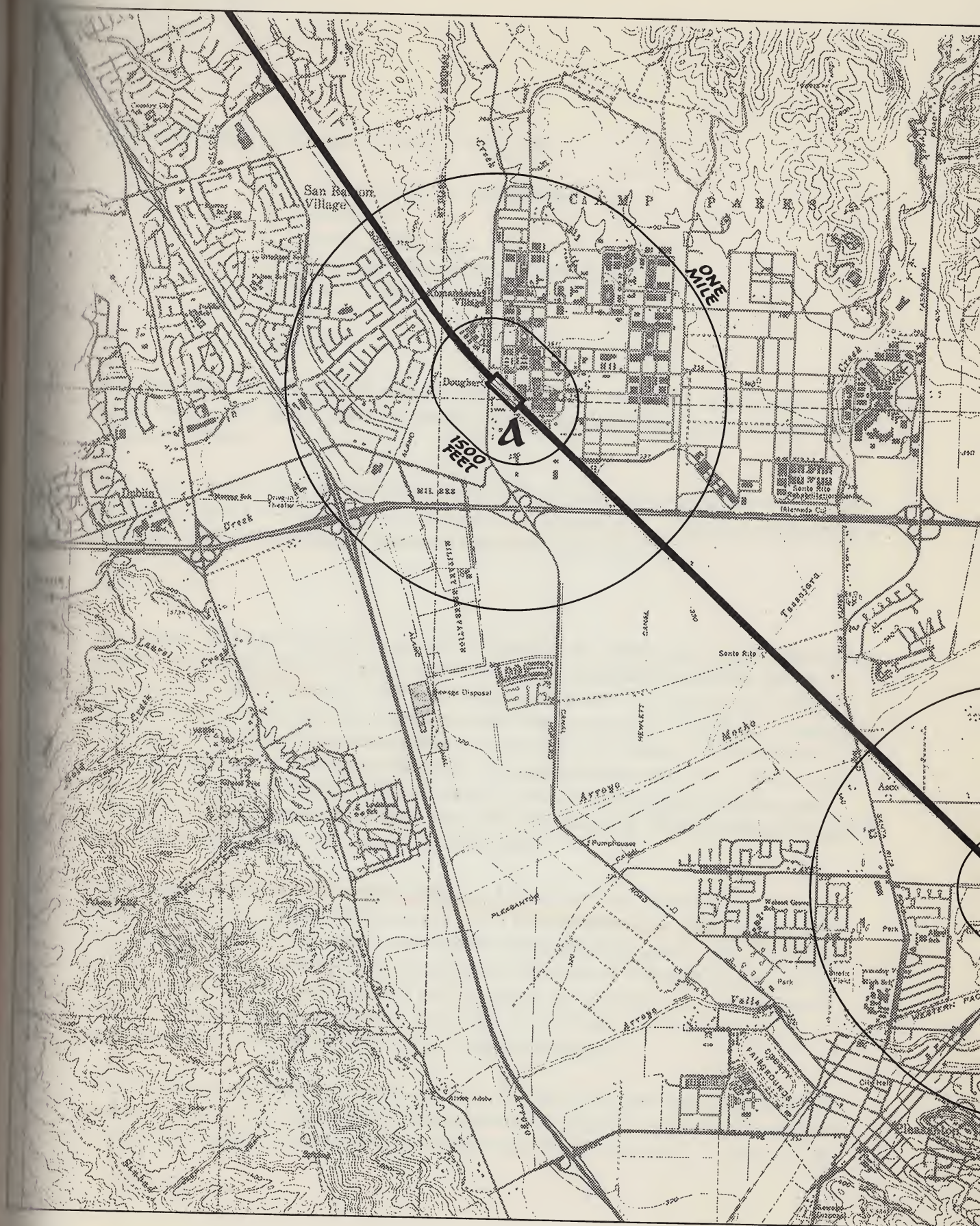


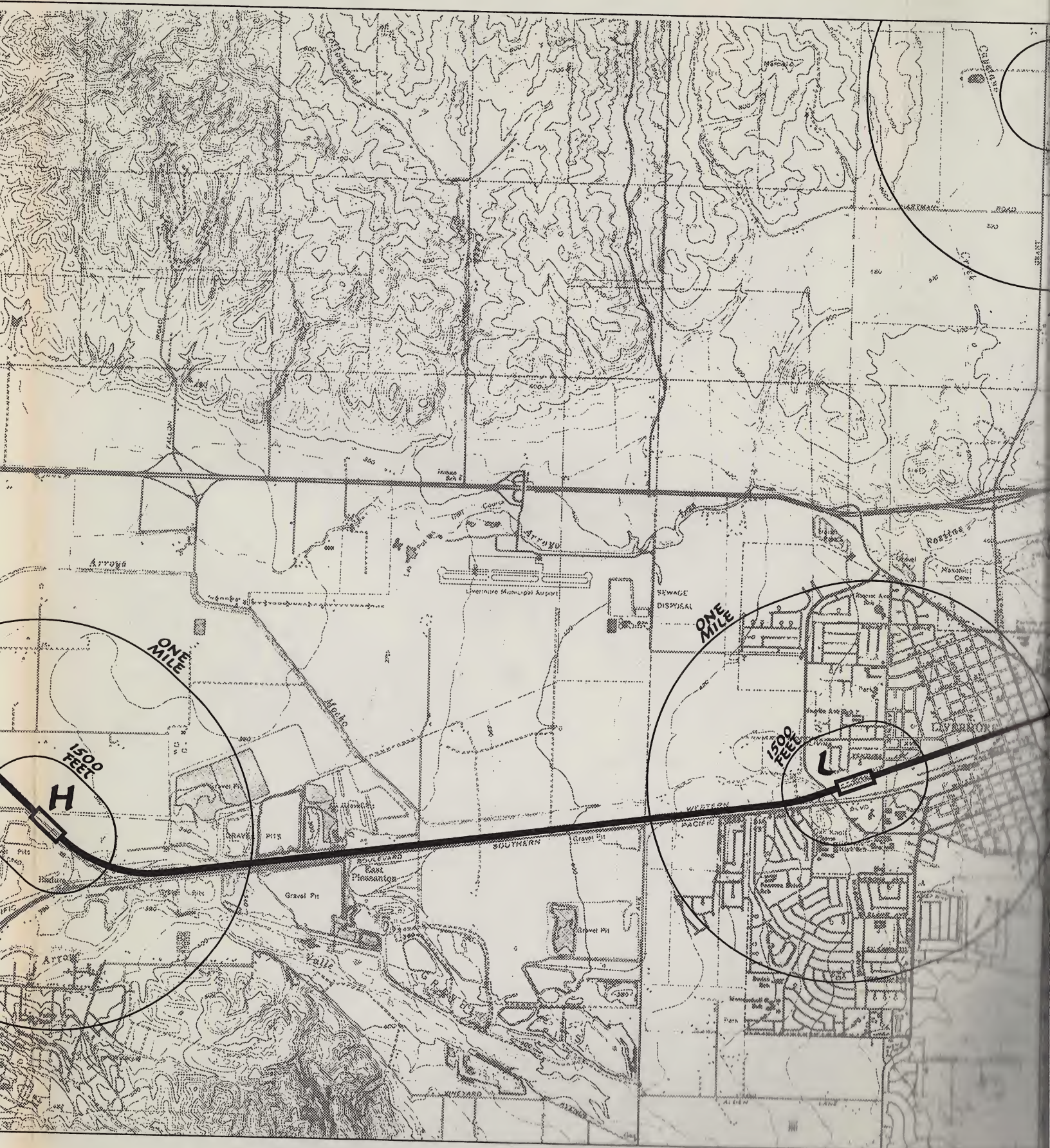




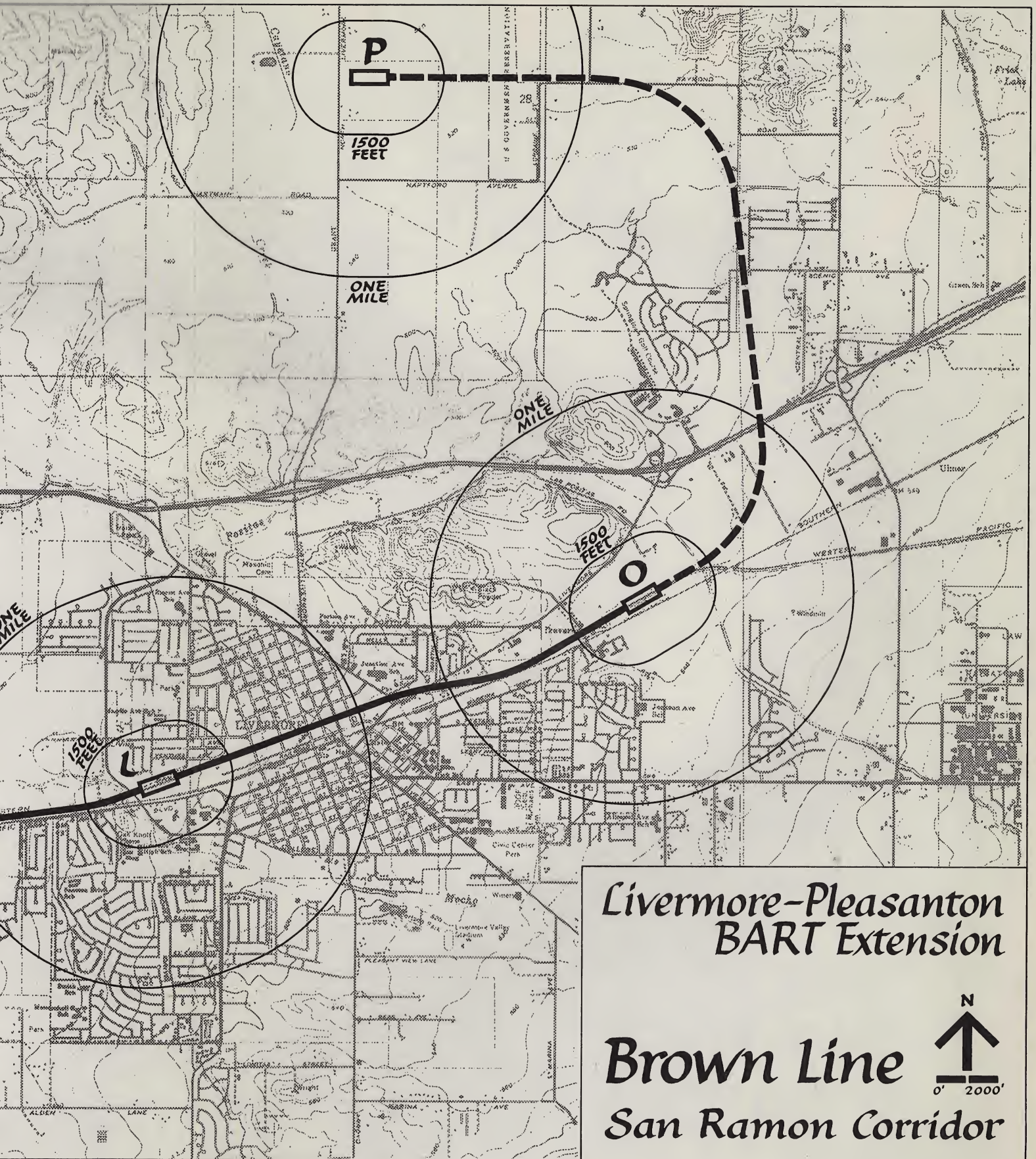
Livermore-Pleasanton BART Extension

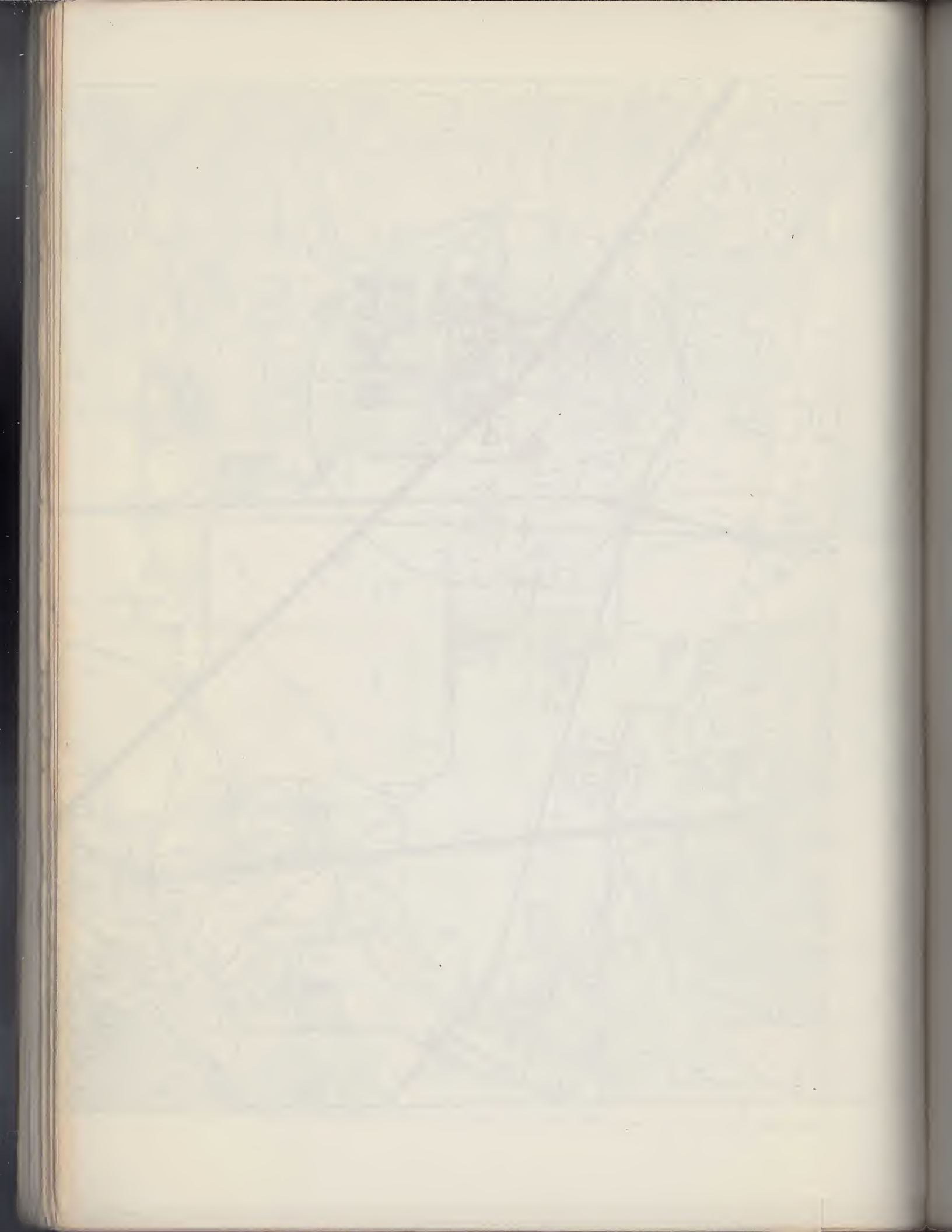
Orange Line 
San Ramon Corridor











For an ordinal ranking seven values are used:

- A - 100 per cent or Exceptional
- B - Excellent
- C - Good, Better than -
- D - Average, Workable, Acceptable
- E - Fair, Less than -
- F - Poor
- G - None.

For the other scales the units of measurement are specified in the tables. They range from feet, jobs, or people to indices based on lineal factored feet or noise levels.

The scale and the unit of measurement are indicated after each criterion in the summary tables of each line's evaluations in Appendix B. Detailed evaluation of corridor segments of these lines are shown in Table 21.

GROWTH

The impact of BART on Valley growth (Objective 8: Minimize Valley population growth, and Objective 9: Do not restrain Valley Population growth) will not be measured until Phase IV, the next evaluation phase. At that time PLUM projections using a peak hour network with BART will be available to compare with the PLUM free-flow network projections now available. The difference in Valley population assigned under the two assumptions will be a crude measure of the impact of BART. The current PLUM 1990 population projections exceed the "high" projection being used for this study by 19 per cent and suggest that high accessibility will cause rapid growth.

BART unquestionably will create additional pressure for residential development in the Valley which, if it occurs, will in turn generate local population-serving employment that will cause more residential demand. The increased demand will raise housing costs relative to alternative residential locations not served by BART, and this will tend to limit the growth rate. The growth policies of local governments are expected to override market forces, but local decisions will not be immune to market influence.

A BART line in the Dublin Canyon corridor would exert the most pressure on growth in the Valley because it would provide the greatest gain in accessibility to regional employment centers in Oakland and San Francisco. A line in the

San Ramon corridor would have somewhat less growth impact because it would not improve accessibility to jobs as much. Thus, efforts to minimize population growth and maximize traveler benefits are in conflict. It will not be possible to estimate the amount of difference of growth impact among corridors.

While there are differences of opinion about the desirability of growth, there is little room for argument with the objective of maximizing traveler benefits. A recommendation favoring a San Ramon line with lower traveler benefits would be based on a view that community impacts are more important than traveler benefits or that the differences in traveler benefits are of insignificant magnitude. The growth issue looms largest in the BART vs. no-BART decision where the difference in impact is expected to be much greater than among alternate corridors for BART service.

BART COSTS

Estimated construction costs for all six lines are developed for Objective 1: Minimize BART construction and operating costs. Total construction costs, cost per mile, and cost per passenger based on the RTTPP preliminary patronage estimates for 1980 HITRANS are computed. Construction cost estimates include the most feasible vertical alignment and the cost of aerial stations and single level parking lot construction. Costs of alternate vertical alignments and of stations based on schematic site plans will be developed for three lines in the next phase, as will right of way and operating costs which are not included here.

All Dublin Canyon lines have lower costs than San Ramon lines. The northern routes through the Valley, the Green Line and the Red Line, have the lowest estimated construction costs, ranging from \$165-172 million. The Blue Line, serving both downtown Livermore and Pleasanton, has an estimated cost of \$186 million, 13 per cent higher than the lowest cost line. Construction cost per mile ranges from \$7.37 million for Green to \$7.92 million for Blue while construction cost per (average daily) passenger is from \$8,000 to \$9,000, based on 1980 RTTPP HITRANS projections.

The total construction cost premium for San Ramon corridor lines is 59-79 per cent over the lowest cost line. Construction costs per mile are 34 per cent to 36 per cent greater, due primarily to the higher costs of aerial structure, and construction costs per passenger are 77 to 100 per cent above the Green Line costs. Preliminary cost estimates for each line are shown in Table 6.

TABLE 6: BART CONSTRUCTION COSTS (Criterion 1 b.)

(Miles)	Rank	Total Cost (Million \$)	Premium	(Million \$)	Premium	(Thousand \$)	Premium
(23.5)	3	\$ 186 ^{a.}	+13%	\$ 7.92	+ 7%	\$ 9.0	+13%
(22.3)	2	172 ^{a.}	+ 4%	7.71	+ 5%	8.3	+ 4%
(22.4)	1	165 ^{a.}	0	7.37	0	8.0	0
(26.6)	4	263	+59%	9.89	+34%	14.1	+77%
(29.6)	6	296	+79%	10.00	+36%	15.9	+100%
(27.2)	5	273 ^{b.}	+65%	10.04	+36%	14.6	+83%

a. Excludes allowance for possible contribution to Division of Highways for providing 80 foot wide median to accommodate BART within reconstructed I-580 from Castro Valley to Dublin. The amount of this contribution is subject to negotiation between BART and the Division of Highways. (For comparison BART contributed \$40 million for modifications to State Highway 24 from Orinda to Walnut Creek including right of way.)

b. Includes \$11,000,000 allowance for reconstruction of I-680 from south Walnut Creek to Danville (right of way not included).

Lines in the San Ramon segment of an extension from Walnut Creek to the Valley have a construction cost estimated to be more than twice that of Dublin Canyon segments: \$183-\$186 million versus \$86-\$90 million. This differential is not due to length alone for the estimated cost per mile in the San Ramon corridor is \$10.5 million as opposed to \$7.5 million in Dublin Canyon assuming each line only had one station. Adding two more stations in the San Ramon corridor increases the estimated cost to \$11 million per mile. The \$90 million capital cost premium to go through the San Ramon corridor could increase with greater right of way costs expected in that corridor, especially in the developed areas to be acquired in Walnut Creek.

The lines that minimize BART costs, subject to changes resulting from adding operating cost or altering vertical alignments, are the Green Line, Red Line, and Blue Line in that order.

TRAVELER BENEFITS

Traveler benefits are evaluated for Objectives 2: Maximize BART usage and 14: Maximize compatibility with existing BART system and with other potential transit extensions. Eleven evaluation criteria were chosen to measure the differences among the lines in the Phase III evaluations. Not all of the criteria turned out to be satisfactory measures; some show little variation while others exhibit counter-intuitive results. In those cases greater emphasis is given to those criteria that are strongly related to the objectives. Instances where this occurred will be noted in the following discussion of the evaluations of traveler benefits.

Objective 2: Maximize BART usage

Regional Transit Travel Patronage Project (RTTPP) preliminary patronage projections, potential patronage, travel times, and the suitability to serve the young, old, poor, and disabled are evaluated to determine compliance with Objective 2: Maximize BART usage. The preliminary patronage estimates, Criterion 2f., for 1980 HITRANS projections assign 20,701 two way work trips to a Dublin Canyon corridor extension, and 18,675 to a San Ramon corridor extension. This 10 per cent advantage of the Dublin Canyon lines increases to 20 per cent if only the trips from the Valley with destinations beyond Walnut Creek or Bay Fair are compared. Fifteen per cent of the trips on a San Ramon extension have neither origins nor destinations outside the corridor compared with only 3 per cent for the Dublin Canyon corridor. Intermediate estimates from the Task II RTTPP model will be available for evaluation in Phase V.

To complement these preliminary patronage projections and to compare lines within a corridor, other measures have been combined in two sets to indicate potential 1980 BART usage and maximum potential BART usage. Potential 1980 BART usage, shown in Table 7, is measured by Criterion 2b., population 1980 within one mile service area of stations (within 2.5 miles for corridor stations), Criterion 2d., accessibility of stations to 1980 population within 8 minutes driving time (corridor stations excluded), Criterion 2e., employment in 1972 within 1,500 feet of stations, and Criterion 2f., RTTPP projections. All of the original summary measures for lines are transformed to a 0-100 percentage scale by dividing all measures by the highest score for each criterion. The original values can be found in the tables in Appendix B. An average score for each line is computed assuming an equal weight for all measures. Varying the weights for the criteria does not change the rank of the best line, although ranks of the other lines are altered.

The Blue Line has the highest 1980 Potential BART usage, 4 per cent above the Orange Line. These two lines are quite close since each provides service to the highly accessible downtown stations. The northern lines, Red and Yellow, have average scores 30 per cent below the Blue Line.

Maximum potential BART usage, summarized in Table 8, combines evaluations of Criterion 2a., population potential within 1,500 feet of stations, Criterion 2c., Population potential within one mile service area (within 2.5 miles for corridor stations) in addition to Criterion 2b., Criterion 2e., 1990 planned employment, and Criterion 2g., 1990 Travel time for Valley patrons. The Blue Line also has the highest rank for maximum potential BART usage followed by the Yellow and Brown Lines. The northern lines, Red and Yellow, have improved scores because of the development potential around stations and a travel time advantage.

Average scores for potential 1980 BART usage and maximum potential BART usage are combined in Table 9. Twice as much weight is assigned to 1980 potential since it has a higher probability than the maximum potential of being realized. The Blue Line has the highest overall rank for Objective 2: Maximize BART usage, based on these 7 criteria. The Orange Line has an average score only 4 per cent below Blue's while all other lines score 17-22 per cent lower.

The Blue Line and the Orange Line have 9-13 per cent greater average travel times for Valley patrons to stations B or D than the Green Line (Criterion 2g.).

TABLE 7: EVALUATION OF POTENTIAL 1980 BART USAGE (Objective 2)^{a.}

<u>Line</u>	<u>Rank</u>	1980 Population within One Mile (2b.)	Accessibility of Stations to 1980 Population (2d.)	1972 Employment within 1,500 feet (2e.)	RTTPP Patronage Projections (2f.)	<u>Average</u>
BLUE	1	100	93	100	100	98
RED	6	88	76	15	100	70
GREEN	3	100	90	31	100	80
YELLOW	5	91	80	21	90	71
ORANGE	2	86	100	100	90	94
BROWN	4	91	83	33	90	74

a. All of the original summary measures for lines are transformed to a 0-100 percentage scale by dividing all measures by the highest score for each criterion. The original values can be found in Appendix B.

TABLE 8: EVALUATION OF MAXIMUM POTENTIAL BART USAGE (Objective 2)^{a.}

<u>Line</u>	<u>Rank</u>	Population Potential within 1,500 feet (2 a.)	Population Potential One Mile (2 c.)	1990 Planned Employment within 1,500 feet (2 e.)	1990 Travel Time Comparison (2 g.)	<u>Average</u>
BLUE	1	77	70	100	91	85
RED	4	78	82	37	97	74
GREEN	5	96	50	39	100	71
YELLOW	2	100	100	39	98	84
RANGE	3	83	67	89	87	82
BROWN	2	86	100	52	96	84

a. All of the original summary measures for lines are transformed to a 0-100 percentage scale by dividing all measures by the highest score for each criterion. The original values can be found in Appendix B.

TABLE 9: SUMMARY EVALUATION OF BART
USAGE (Objective 2)

<u>Line</u>	<u>Rank</u>	<u>Potential 1980 BART Usage</u>	<u>Potential Maximum BART Usage</u>	<u>Weighted Average</u> ^{a.}
BLUE	1	98	85	94
RED	5	70	74	71
GREEN	3	80	71	77
YELLOW	4	71	84	75
ORANGE	2	94	82	90
BROWN	3	74	84	77

- a. Twice as much weight is assigned to 1980 potential since it has a higher probability than the maximum potential of being realized.

While Blue and Orange score high on accessibility because they have large populations nearby, the average trip times for patrons walking or driving to their nearest station and taking BART to the edge of the Valley would be longer. The actual difference in riding time from Station M in Livermore between the Blue Line (through downtown Pleasanton) and the Green Line (through the northern Valley) is one minute, but the average travel time is 1.3 minutes longer on Blue because many patrons must travel out of direction to reach stations on a south Valley line.

Further travel time penalties are imposed on BART patrons traveling on a San Ramon extension. The Yellow and Brown Lines have 13 minute penalties for Oakland (Lake Merritt) and 10 minute penalties for San Francisco trips because of the longer distance through Walnut Creek. RTTPP's preliminary patronage projections show that the Dublin Canyon lines provide better service to the long distance commuter working in the regional employment centers; 75 per cent of the commuters using a Dublin Canyon extension work in Oakland or San Francisco in contrast to 63 per cent of the BART patrons on a San Ramon extension. After adjusting for the riders in the corridors who would drive to existing BART stations and then ride to work if there were no extension, the net increase in BART commuters to Oakland and San Francisco is 35 per cent higher with a Dublin Canyon extension than with a San Ramon line. (8,250 versus 6,100 daily work trips.) Even with the 25 per cent lower value assigned to travel time on BART as compared with auto under a RTTPP HITRANS assumption, the 10-13 minute travel time penalty in the San Ramon corridor lowers patronage volumes on a Valley extension.

Twenty to thirty-five per cent more commuters are potential BART riders with a Dublin Canyon extension to the Valley than with a San Ramon extension because it would be 20 to 25 per cent faster for the majority who work in Oakland and San Francisco.

Objective 14: Maximize compatibility with the existing BART system and with other potential transit extensions.

The Dublin Canyon lines, as shown earlier, will not strain the capacity of the existing system as much as the San Ramon lines. Based on an analysis of 1980 HITRANS RTTPP projections, an extension through Walnut Creek would have 120 per cent standees on the Concord line during the peak hour. Accordingly, the Orange, Yellow, and Brown lines are ranked E for Criterion 14 a., available capacity on existing BART line. An extension through Dublin Canyon would have 67 per cent standees for San Francisco bound trains on the Fremont line while Richmond bound trains would have empty seats. So, the Blue, Red, and Green Lines are ranked C for this criterion.

The evaluation of compatibility with future transit extension in other corridors is based on sketch plans of transit extensions and tie-in configurations. Measures of compatibility include such factors as sequence of extensions in different corridors, suitability of stations for transfer, efficiency of transfer, access to yard, operational efficiency, and neighborhood disruption. The interface with transit in other corridors will be studied in detail and evaluated for two or three lines in Phase IV. The Red, Brown, and Green lines have the greatest compatibility with future transit extensions in other corridors. The Orange Line has the greatest compatibility with transfers to a bus system, Criterion 14b., while the Red, Brown, and Green Lines have the greatest compatibility with transfers to a rail system, Criterion 14c.

For a synthesis of these measures, the impact of an extension on available capacity is weighted more heavily than potential for transfers to a bus system, which, in turn, is rated as more important than potential transfers to a rail system. The Red and Green Lines best comply with Objective 14. The overall rankings and ordinal evaluations for all three criteria are summarized in Table 10.

Summary of Traveler Benefits

In a summary judgment on traveler benefits, it is assumed that potential service to residents in the San Ramon corridor and to Walnut Creek and Concord is subordinate to travel time comparisons, compatibility with the existing system and future transit extensions, and preliminary patronage projections. San Ramon lines are downgraded for inferior service to a majority of Valley commuters and for causing severe overloading of the Concord Line. No line emerges as superior by all measures, but the Blue and the Green Lines score well on balance and are judged to provide the greatest traveler benefits.

TABLE 10: EVALUATION OF COMPATIBILITY WITH EXISTING BART SYSTEM
AND POTENTIAL EXTENSIONS (Objective 14)

<u>Line</u>	<u>Rank</u>	<u>Available Capacity on Existing BART Line (14 a.)</u>	<u>Compatibility with Transfers to a Bus System (14 b.)</u>	<u>Compatibility with Transfers to a Rail System (14 c.)</u>
BLUE	5	C	D	D-
RED	1	C	D	A-
GREEN	2	C	C-	B-
YELLOW	6	E	C	C+
ORANGE	4	E	B-	D+
BROWN	3	E	C	B+

COMMUNITY IMPACTS

For Phase III, five objectives are evaluated for impacts of BART extensions on the urban environment and two objectives for impacts on the natural environment. Most of the measures of community impacts are on an ordinal scale. These measures are combined by an analysis of the frequency distribution of the ordinal values. The measures of all stations and links are summed separately for each ordinal value, from A to G. An average score of D is judged unacceptable, so the per cent C or better is computed. These percentages then provide the basis for ranking lines to determine compliance with an objective.

The summaries under each objective show the relative differences among lines. For the specific values assigned to links and stations the reader is referred to Appendix B.

Urban Environment

Objective 4: Avoid change in presently developed residential neighborhoods.

Five criteria are evaluated for this objective, three on an interval scale and two on an ordinal scale. The interval measures are the indices of disruption and potential change in residential neighborhoods shown in Table 11: Criterion 4 a. , proximity of stations to existing development, Criterion 4 b. , propensity for change in neighborhoods near BART stations, and Criterion 4 c. , line disruption. The Red Line, with the lowest propensity for change, and the least line disruption is ranked first. The Orange Line and the Brown Line, ranked second and third, have average scores within 10 per cent of the Red Line.

Turning to the ordinal evaluations, the Red and Green Lines cause less traffic disruption (Criterion 4 d.) and stations disruption (Criterion 4 e.) than the other four lines and require the least acreage in already built up areas for parking and station sites. All of the ordinal evaluations of traffic disruption for these two lines and 60 per cent of the evaluations of station disruption are C or better. The Orange Line's poor ranking for traffic disruption and station disruption drops it to fifth place. The frequency distribution of these ordinal ranks and the overall rank order assigned to each Line are presented in Table 12. The Red Line best satisfies this objective.

Corridor Comparisons. The total adverse impact of stations and routes on the urban environment in the San Ramon corridor is greater than in the Dublin

TABLE 11: INDICES OF DISRUPTION AND POTENTIAL CHANGE
IN RESIDENTIAL NEIGHBORHOODS (Objective 4)^{a.}

	<u>Rank</u>	<u>Proximity of Stations to Existing Development (Criterion 4 a.)</u>	<u>Propensity for Change in Neighborhoods near BART Stations (Criterion 4 b.)</u>	<u>Line Disruption (Criterion 4 c.)</u>	<u>Average</u>
11	4	14	58	79	50
	1	17	63	91	57
BN	5	11	51	86	49
LOW	6	23	43	77	48
ANGE	2	29	62	67	53
WN	3	27	52	74	51

- a. All of the original summary measures for lines are transformed to a 0-100 percentage scale by dividing all measures by the highest score for each criterion. The original values can be found in Appendix B.

TABLE 12: EVALUATION OF TRAFFIC DISRUPTION AND STATION DISRUPTION
(Criterion 4 d. and 4 e.)

<u>Line</u>	<u>Rank</u>	<u>Per Cent C or Better</u>	<u>Per Cent D or Worse</u>	<u>Frequency Distribution of Ordinal Values</u>					
				<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>
BLUE	6								
Traffic Disruption		60%	40%		1	2		1	1
Station Disruption			100%				4	1	
(developed acreage req'd - 35)									
RED	1								
Traffic Disruption		100%		1	2	2			
Station Disruption		60%	40%		2	1	2		
(developed acreage req'd - 11)									
GREEN	2								
Traffic Disruption		100%			3	2			
Stations Disruption		60%	40%		1	2	2		
(developed acreage req'd - 13)									
YELLOW	3								
Traffic Disruption		86%	14%	1	3	2		1	
Station Disruption		71%	29%		4	1	1	1	
(developed acreage req'd - 13)									
ORANGE	5								
Traffic Disruption		57%	43%	1	1	2	1	1	1
Station Disruption		43%	57%		2	1	3	1	
(developed acreage req'd - 20)									
BROWN	4								
Traffic Disruption		86%	14%	1	2	3	1		
Station Disruption		57%	53%		3	1	3		
(developed acreage req'd - 13)									

Canyon corridor. The San Ramon lines have seven times the disruption and more acreage impacted by station development than do the lines in the Dublin Canyon. Lines in the Dublin Canyon corridor have greater propensity for change on balance. Dublin Canyon lines best satisfy Objective 4: Avoid change in presently developed residential neighborhoods.

Objective 5: Maximize environmental compatibility.

In Phase III the impact of the lines on the urban environment is measured by three criteria and the impact on the natural environment by one. The measures defined in the Evaluation Criteria Report for Criterion 5 b., Visual and psychological barriers and 5 c., Visual quality were not clearly differentiated. Two new criteria, described below, are substituted for 5 b. and 5 c.

5 b. Visual and physical fit.

An ordinal ranking of the degree of freedom from problems of physical fit found in placing the BART track or station, with special attention to the creation of visual, physical, and psychological barriers.

5 c. Urban design potential.

A ranking of the potential at each station area to reinforce and revitalize existing development and to stimulate high quality architectural and environmental design. Ratings will include a judgment of the cumulative visible environmental change a station area might undergo as a result of BART construction and successful operation over a 20-30 year period.

The Blue Line has the highest ranking for these two new criteria and is also ranked first in an evaluation of noise levels (Criterion 5 a.) giving it the highest compatibility with the urban environment. Second is the Green Line with a first for noise levels, a second for visual and physical fit, and a fourth for urban design potential. The ranks are summarized in Table 13. Tables 14 and 16 show the frequency distribution of the ordinal ranks summarized by station and by link for each criterion. Detailed evaluations are in Appendix B.

Corridor Comparisons. Noise impacts (5 a.) in the San Ramon corridor range from high to moderate to low. In the Dublin Canyon corridor noise impacts are judged nominal. In the San Ramon corridor visual and physical fit (5 b.) and urban design potential (5 c.) are judged poor, while in the Dublin Canyon corridor these factors are rated good to excellent. Therefore, Dublin Canyon has superior compatibility with the urban environment.

TABLE 13 : COMPATIBILITY WITH THE URBAN ENVIRONMENT
(Criteria 5 a. ,b. ,c.)

<u>Line</u>	<u>Rank of Compatibility with the Urban Environment</u>	<u>Noise Levels (5 a.)</u>	<u>Visual and Physical Fit (5 b.)</u>	<u>Urban Design Potential (5 c.)</u>
BLUE	1	1	1	1
RED	3	2	4	2
GREEN	2	1	2	4
YELLOW	4	4	3	3
ORANGE	6	5	6	5
BROWN	5	3	5	5

TABLE 14: EVALUATION OF NOISE LEVELS (Criterion 5 a.)

	Rank	Per Cent C or Better	Per Cent D or Worse	Frequency Distribution of Ordinal Values						
				<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>
Links	1	100%			4	1				
Links	2	80%	20%	2	1	1	1			
Links	1	100%			4	1				
Links	4	57%	43%		2	2	1		2	
Links	5	29%	71%	1	1		3	1		1
Links	3	71%	29%	1	2	2	1		1	

TABLE 15: EVALUATION OF VISUAL AND PHYSICAL FIT (Criterion 5 b.)

<u>Line</u>	<u>Rank</u>	<u>Per Cent C or Better</u>	<u>Per Cent D or Worse</u>	<u>Frequency Distribution of Ordinal Values</u>					
				<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>
BLUE	1								
Stations		60%	40%		1	2	1	1	
Links		20%	80%		1		3	1	
RED	4								
Stations		40%	60%			2	1	2	
Links		20%	80%			1	3	1	
GREEN	2								
Stations		40%	60%			2	2	1	
Links		20%	80%			1	3	1	
YELLOW	3								
Stations		29%	71%			2	3	2	
Links		43%	57%			3	3	1	
ORANGE	6								
Stations			100%				5	2	
Links		14%	86%			1	3	3	
BROWN	5								
Stations			100%				4	3	
Links		29%	71%			2	3	2	

TABLE 16: EVALUATION OF URBAN DESIGN POTENTIAL (Criterion 5 c.)

	<u>Rank</u>	<u>Per Cent C or Better</u>	<u>Per Cent D or Worse</u>	<u>Frequency Distribution of Ordinal Values</u>						
				<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>
Stations	1	80%	20%		1	3			1	
Stations	2	40%	60%		1	1	1	1	1	
Stations	4	20%	80%		1		1	2	1	
Stations	3	29%	71%		1	1		4	1	
Stations	5	14%	80%			1	1	4	1	
Stations	5	14%	80%			1	1	4	1	

Objective 6: Minimize inequities created by a BART extension.

For this objective displacement created by a BART extension (Criterion 6 a.) is evaluated for the six lines. Since the evaluation is on an ordinal scale, a frequency distribution of the ordinal values for stations and links provides the basis for determining the preliminary ranking.

The Red Line best satisfies the objective with four stations and five links judged C or better and only one station judged D. The Green Line has similar characteristics, but slightly greater displacement in the section through Livermore, and so is quite close to the Red Line in its compliance with the objective. Next is the Yellow Line which is penalized for the significant displacement in Walnut Creek. The Brown Line has not only the displacement in Walnut Creek but slightly more serious problems on the L-O link than Yellow has on the K-O link. The Orange Line and the Blue Line cause displacement in both downtown Pleasanton and downtown Livermore. The summary of the ordinal ranks for the stations and the links on the lines is shown in Table 17. The specific evaluations of each station and link are in Appendix B.

Corridor Comparisons. The inequities created by a San Ramon extension appear greater than those created by a Dublin Canyon extension. The displacement at the Walnut Creek point of connection will be far greater than at Bay Fair, but the potential station disruption around Castro Valley station is worse than around the stations in the San Ramon corridor. Line disruption in the San Ramon corridor measures 47,000 feet compared with 6,500 feet in the Dublin Canyon corridor.

Objective 11: Maximize economic development at point of connection to existing BART line.

Three criteria measure the impact of BART at the point of connection: Criterion 11a., Jobs projected in 1990 within one mile of extension terminal; Criterion 11b., Net change in RTTPP projected attractions with an extension; and Criterion 11c., Development potential near extension terminal. Criterion 11b., previously defined as RTTPP patronage projections at extension terminal, now is redefined as a measure of the increase in BART patrons working near an extension terminal with an extension to the Valley.

TABLE 17: EVALUATION OF DISPLACEMENT BY STATIONS & ROUTES (Criterion 6a.)

	Rank	Per Cent C or Better	Per Cent D or Worse	Frequency Distribution of Ordinal Values						
				<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>
Stations Links	6	40%	60%	2			1		2	
		80%	20%	1	1	2				1
Stations Links	1	80%	20%	3	1		1			
		100%		3	2					
Stations Links	2	80%	20%	2	2		1			
		80%	20%	3	1		1			
Stations Links	3	100%		4	1	2				
		86%	14%	5	1		1		1	
Stations Links	5	86%	14%	3	1	2			1	
		71%	29%	4		1		1	1	
Stations Links	4	100%		4	1	2				
		71%	29%	5			1		1	

The Dublin Canyon lines are ranked E for Criteria 11a. and 11c. At Bay Fair and Castro Valley a minimal amount of commercial retail and office employment will shift to the area around stations because there are better alternative locations. Only through an aggressive redevelopment program would there be a sufficient change of image and a site available to stimulate large scale sub-regional or local commercial and office development.

In Walnut Creek the impact of BART would be greater, adding to downtown development expected even without a BART extension to the Valley. The prestige of Walnut Creek, the development that is occurring, the proximity to high-income areas, and the economic feasibility of being able to build at higher densities combine to make the development potential greater than at Bay Fair and Castro Valley. For these reasons the San Ramon lines are ranked C for Criteria 11a. and 11c. providing the extension line connects to the existing Walnut Creek Station where an increase of 1,900 jobs within walking distance is projected by 1990 if the extension is built. However, the disruption that would be caused by building a line to this station may be unacceptable. The two South Walnut Creek stations evaluated in this report are too far from downtown to have any measurable impact, dropping the rating to D if they are assumed as alternates.

Analysis of RTTPP projections indicates 313 more work trips on BART are attracted to Bay Fair and Castro Valley with a Dublin Canyon corridor extension, while an extension through the San Ramon corridor only adds 74 trips to the total attractions at Walnut Creek and South Walnut Creek. If RTTPP is right, 52 per cent more workers would use BART to go to Bay Fair and Castro Valley with an extension to the Valley while at Walnut Creek the increase would be only 7 per cent. In Table 18 total trips attracted at each extension terminal and at the next closest station on an extension are compared. This measure indicates a potential for moderately greater economic interaction between the Valley and Hayward/Castro Valley than between the Valley and Walnut Creek.

Because the results of the three measures for this objective conflict, neither corridor can be rated markedly superior. Lines through Walnut Creek appear to have more potential for maximizing economic development at the point of connection.

TABLE 18: RTTPP PROJECTIONS AT EXTENSION TERMINALS
(Criterion 11 b. - Net change in RTTPP projected attractions with an extension)

<u>Extension Terminals</u>	<u>Two-way 1980 HITRANS Work Trips</u>		
	<u>Dublin Canyon Corridor</u>	<u>San Ramon Corridor</u>	<u>Difference in in Work Trips Attracted</u>
DAYFAIR			
Trip attractions	451	605	
Antio Valley trip attractions	467	0	
	918	605	+313 with BART in Dublin Canyon Corridor
WALNUT CREEK			
Trip attractions	1,026	681	
Walnut Creek trip attractions	0	419	
	1,026	1,100	+ 74 with BART in San Ramon Corridor

Objective 13: Maximize compatibility with existing general plans

Conflicts with existing general plans occur where BART runs through an urbanized area creating pressures for changes in the designated land use pattern. At some stations in the Valley it would be desirable to change the currently planned industrial land use to residential to accommodate high density BART-oriented development. In the San Ramon corridor low density single family residential areas near several stations would be subject to pressure for higher density development.

The line with the least conflict is the Yellow Line, followed by the Red and Blue Lines. The ranks of the other lines and the frequency distribution of the ordinal measures of Criterion 13 a., Degree of conflict with existing general plans, are in Table 19. The generally low ratings show that substantial general plan modifications would be necessary to accommodate BART, but many of the changes would not be contrary to the intent of current plans.

Natural Environment

The natural environmental issues are evaluated in Phase II by Criterion 5 e., Disturbance of land forms, vegetation, waterways, wildlife, and Objective 7: Preserve maximum open space. For the first evaluation the impacts on the natural environment occur in an already disturbed area and so are marginal. A BART extension would make major alterations in the environment that will be highly visible and of great importance to local interest groups, but it should be remembered that the impacts and the differences among lines described below, while significant, are not major or severe.

Criterion 5 e. Disturbance of land forms, vegetation, waterways, wildlife.
For this criterion the lines have been ranked in the following order:

- 1 Brown
- 2 Yellow
- 3 Orange
- 4 Blue
- 5 Red
- 6 Green

All three San Ramon lines are favored over Dublin Canyon lines, as there is less grading required, fewer hillside scars, and less opportunity for stream channel encroachment. Station A on the Brown Line has fewer seismic hazards and soil drainage problems than other Dublin-Northwest Pleasanton stations. Its

TABLE 19: DEGREE OF CONFLICT WITH EXISTING GENERAL PLANS
(Criterion 13 a.)

Line	Rank	Per Cent C or Better	Per Cent D or Worse	Frequency Distribution of Ordinal Values						
				A	B	C	D	E	F	G
BLUE	2		100%				4	1		
RED	2		100%				4	1		
GREEN	5		100%				2	3		
YELLOW	1	14%	86%			1	4	2		
RANGE	4		100%				4	3		
BROWN	3	14%	86%			1	3	3		

influence zone is also less susceptible to erosion and landslides than that around Station D. Although there is poor natural drainage around Stations F and G, these areas are already protected by flood control channels. Station H is preferred in terms of natural drainage over Station J. The route from A to H and thence to L, M, and O has a minimum of problems since it follows the S.P. tracks except at Station L where the Arroyo Mocho's natural vegetation and flood problems must be taken into account.

The Yellow Line also profits from a north entrance, but its Valley route is not especially suitable. Areas west and south of stations F and G are poorly drained and active seismically. Route G-K has few environmental problems, but does involve new construction as opposed to those routes that use the railroad right of way. The Yellow Line also has the disadvantage of including Station K which is directly on Las Positas Creek (with flooding and ground water recharge issues) and in putting pressure on undeveloped foothills to the north. Station O has poor natural drainage and would create development pressures on nearby foothills.

Through the San Ramon corridor the Orange Line has impacts similar to the Brown and Yellow Lines. In the Valley Station B puts development pressure on an area of more severe hazard in terms of drainage and seismicity. Route B-J is favorable in that it follows the already channelized watercourse. However, it does parallel or override the Calaveras fault zone. Station J impinges on areas of seismicity, poor natural drainage, and potential flooding. It also could put development pressure on Pleasanton Ridge which has the most serious landslide potential of all hills in the entire Livermore-Pleasanton region.

The Blue Line is less favored because it traverses Dublin Canyon. Station D has serious seismic questions and puts development pressure on the foothills southwest of Dublin (with moderate erosion and landslide potential). Station I puts pressure on the development of the foothills southeast of Pleasanton with problems of surface erosion and moderate landslide hazard.

Not only does the Red Line suffer from a Dublin Canyon entry and the problems of Station B but, like Yellow, it involves new construction and opens up presently undeveloped areas. Finally, the Green Line has, in addition to the drawbacks discussed above, the problems of natural drainage and seismicity around Station E. Otherwise, the alignment from F eastward is acceptable although from G to L it represents new construction in an otherwise undeveloped area.

Objective 7: Preserve Maximum Open Space

For Phase III the evaluation of a line to preserve open space is measured by Criterion 7 a. , Population Potential within 1,500 feet, and Criterion 7 b. , Population potential within one mile. Since the basic measure for this objective , Criterion 7 c. , Total urban acreage vs. a no-BART Alternative, will be made in Phase IV, the present ratings of lines show only the potential reduction in scatter with BART-induced high density development around stations. The Yellow Line and the Green Line have the highest composite indices. The fact that the lowest index is only 85 shows the lines do not differ significantly. The measures for both criteria, their average, and the overall rank for this objective are shown in Table 20.

Summary of Community Impacts

Finding the line with the least adverse community impacts is simplified by first choosing the corridor and then the Valley route with the least community impacts. The conflict that has to be resolved for both of these questions is the relative importance of natural environmental values as opposed to urban (human) environmental values.

Tackling the corridor issues first, the San Ramon line is favored for less adverse natural environmental impact. Counter to this positive factor is the increased displacement and disruption especially in Walnut Creek. For physical and visual fit and urban design potential the San Ramon corridor lines rank lower than those through Dublin Canyon. San Ramon lines cause more change in presently developed neighborhoods and greater inequities than do Dublin Canyon lines. The economic impact of an extension is somewhat more favorable for Walnut Creek (with connection to the existing station) than for Bay Fair.

If impacts on the urban environment are judged more important than incremental impacts on an already disturbed natural environment, the Dublin Canyon lines should be favored. The impact on the natural environment can be more easily mitigated in the Dublin Canyon corridor by sensitive planning and design than the adverse impacts on the urban environment in the San Ramon corridor.

Turning to the Valley segments of the lines, the Red Line is least detrimental to urban development, creating minimum disruption and displacement. However, this line is not as compatible with the urban environment as the Blue Line running through both downtowns. Favorable ratings for the lines serving the downtowns are based on the urban design potential that exists, but they are not qualified by economic judgments as to whether that potential can be realized. At this point

in the study no clear resolution between the choices of minimizing disruption and maximizing urban design potential in Valley communities is possible. Schematic site plans and additional economic studies in the next evaluation phase will enable more precise descriptions of the trade-offs.

TABLE 20: EVALUATION OF MAXIMUM OPEN SPACE PRESERVATION (Objective 7) ^{a.}

<u>Line</u>	<u>Rank</u>	<u>Population Potential Within 1,500 Feet Of Stations (Criterion 7a.)</u>	<u>Population Potential Within One Mile Service Area of Stations (Criterion 7b.)</u>	<u>Average</u>
BLUE	5	77	98	88
RED	4	78	100	89
GREEN	2	96	93	95
YELLOW	1	100	99	100
ORANGE	6	83	86	85
BROWN	3	86	99	93

a. All of the original summary measures for lines are transformed to a 0-100 percentage scale by dividing all measures by the highest score for each criterion. The original values can be found in Appendix B.

RECOMMENDATIONS FOR FURTHER STUDY

The conclusion that must be reached from the evaluations in this report is a narrowing of the number of BART line alternatives under study from six to two or three. Since lines in both Valley access corridors fit nearly all alternate Valley stations and links, a decision on the corridor alternatives can be made separately from a decision on lines within the Valley. Measures of the key evaluation criteria that describe differences between the corridors are contained in this report. Within the Valley the characteristics of the alternates have not yet been so clearly differentiated. Schematic plans and economic analyses of the alternate Valley stations in the next evaluation phase will indicate which set of stations and links is superior, or at least will define the trade-offs more clearly than is possible now.

The summation of corridor evaluation criteria follows. Specific measures are in Table 21.

Growth: A San Ramon line would cause somewhat less growth pressure in the Valley because it would have lower traveler benefits.

BART Cost: A Dublin Canyon line would cost at least \$77-\$98 million (25-37 per cent) less than a San Ramon line, exclusive of right of way and operating cost which would be much higher for a San Ramon line. The cost per passenger on a Dublin line would be at least 36-43 per cent less.

Traveler Benefits: A Dublin Canyon line would attract 20-35 per cent more commuters because it would be 20-45 per cent faster for those who work in Oakland or San Francisco. It would save 10-13 minutes over a San Ramon line if the connection were at Lafayette Station and 14.5-17.5 minutes over a Walnut Creek station connection. A Dublin Canyon line would result in about one-half as many potential standees on existing BART lines. San Ramon corridor stations would have a tributary 1990 population of 71,000 compared with 63,000 for the only station in the Dublin corridor.

Community Impacts (Urban Environment): Dublin Canyon lines have one-seventh as much lineal footage of major disruption of existing residential neighborhoods and less acreage impacted by station development than San Ramon lines. Dublin Canyon corridor lines have much less noise impact, better visual and physical fit, and offer more potential for high quality urban design. Displacement in Walnut Creek would be severe. A BART connection to the Walnut Creek station is estimated to add 1,900 jobs nearby, while a Bay Fair connection would have little impact.

Community Impacts (Natural Environment): San Ramon lines require less grading, create fewer hillside scars, and offer less opportunity for stream channel encroachment than Dublin Canyon lines.

The study team believes that the margins of superiority in cost, traveler benefits, and urban environmental impact of the Dublin Canyon lines are so great that they could not be overbalanced by somewhat better ratings for impact on the natural environment or by favorable outcomes for criteria not evaluated during this phase for the San Ramon corridor. Consequently, we recommend that no further studies of BART rail service in the San Ramon corridor be made at this time, and that the following phase of this study concentrate on more detailed comparisons of the three Dublin Canyon lines.

TABLE 21: EVALUATION OF CORRIDOR SEGMENTS

Judgment measures on an ordinal scale:

A-100% or exceptional; B-excellent; C-good, better than--; D-average, workable, acceptable; E-fair, less than--; F-poor; G-none.

	Dublin Canyon Lines	San Ramon Lines		
		Yellow	Orange	Brown

Scale; Unit of Measurement

1. Objective: Minimize BART Construction and Operating Costs		Ratio; million \$	86-90	183	185	186
b.	Total capital cost					
2. Objective: Maximize BART Usage		Ratio; persons	4,200	8,500	8,500	6,600
a.	Population potential within 1,500 ft. of stations	Ratio; persons	52,300	52,700	42,200	52,700
b.	1980 tributary population	Ratio; persons	11,100	17,300	13,100	17,300
c.	Tributary population potential 1980-1990	Ratio; persons				
e.	Existing and potential employment within 1,500 feet of stations	Ratio; persons	300	600	900	220
	1972	Ratio; persons	(500)	(2,800)	(3,200)	(2,020)
f.	RTTPP patronage projections, 1980	Ratio; work trips	20,701	18,675	18,675	18,675
g.	Average travel time penalty to San Francisco/Oakland for BART patrons	Ratio; minutes	0	10-13	10-13	10-13
h.	Suitability to serve young, old, poor, and disabled	Ordinal	E	E	F	G

4. Objective: Avoid Change in Developed Residential Neighborhoods		Interval; index increases with distance	0	33	33	33
a.	Proximity of stations to existing development					
b.	Propensity for change in neighborhoods near BART stations	Interval; index decreases with acreage subject to change	0	23	23	23
c.	Line disruption	Interval; index decreases with lineal ft. of impact	93	56	55	56
d.	Traffic disruption	Ordinal	C	C	C	C
e.	Station disruption	Ordinal	D	C	D	C
	Ratio; acres acquired		10	12	12	12

5. Objective: Maximize Environmental Compatibility

a. Noise levels		Ordinal; rank based on lineal feet			
b. Visual and physical fit		B	D	D	B
c. Urban design potential		C	D	D	D
		B	E	E	E

6. Objective: Minimize Inequities Created by a BART Extension

a. Displacement by stations or routes	Ordinal	B	C	C	C
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7. Objective: Preserve Maximum Open Space

a. 1980 Tributary population	Ratio; persons	4,200	8,500	8,500	6,600
b. 1990 tributary population	Ratio; persons	63,400	70,700	55,300	70,700

11. Objective: Maximize Economic Development at Point of Connection to Existing BART Line

a. Net change in jobs projected in 1990 within 1 mile of extension terminal	Ordinal	E	C	C	C
b. Net change in RTTPP projected attractions with an extension	Ratio; trips	+313	+74	+74	+74
c. Development potential near extension terminal	Ordinal	E	C	C	C

13. Objective: Maximize Compatibility with Existing General Plans

a. Degree of conflict with existing general plans	Ordinal	E	E	E	E
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14. Objective: Maximize Compatibility with Existing BART System and with Other Potential Transit Extensions

a. Available capacity on existing line	Ordinal	C	E	E	E
b. Compatibility with transfers to a bus system	Ordinal	C	C	D	B
c. Compatibility with transfers to a rail system	Ordinal	D	C	B	C

APPENDIX A: DESCRIPTION OF LINES

BLUE LINE (Dublin Canyon - South Valley)

From Bay Fair Station the Blue Line (23.5 miles) proceeds south along the east side of the existing BART line, passes under the westbound freeway lanes and enters the median of Highway 238 west of Mission Boulevard. The line follows the median of Highway 238 to the 238/I-580 interchange, and then continues in the median of the reconstructed I-580 freeway to a Castro Valley Station (4,000 passengers; 1,000 parking spaces; 12 acres). The station would be served by Redwood Road with direct access to and from I-580 from the west via a proposed half-diamond interchange and by Aspen Avenue on the east. Aspen Avenue extends northeast to Castro Valley Boulevard. A majority of the station users are expected to arrive from the north via Redwood Road. Arrivals from the east will use Aspen Road.

By 1990 congestion will occur on Redwood Road at the I-580 diamond ramps, at the station access road and at the intersection with Castro Valley Boulevard. It is likely that widening to provide for a double left turn lane into the station would be necessary. The intersection of Castro Valley Boulevard and Aspen Avenue should present no great difficulties.

A possible alternate station location at Lake Chabot Road will be studied as will alternates providing a connection to the existing Hayward BART station. From a Castro Valley station the Blue Line follows the median of the reconstructed I-580 freeway through Dublin Canyon. East of Castro Valley an alternative that might require less earth work in the reconstruction of I-580 by allowing lower freeway design speeds is to tunnel through Sunol Ridge between Don Castro Reservoir and Palomares Canyon. However, this would encroach on Don Castro Regional Recreation Area.

West of Foothill Road the Blue Line turns southeast over the eastbound freeway lanes of I-580 and on aerial structure heads across Foothill Road to the Dublin Station D (2,700 passengers; 1,300 parking spaces; 14 acres) located north of Stoneridge Drive on the south side of a proposed regional shopping center.

Access to Station D is from Stoneridge Drive off Foothill Road. A new interchange with I-680 proposed in conjunction with the Stoneridge regional shopping center will provide direct freeway access via Stoneridge Drive. Congestion caused by traffic generated by the proposed regional shopping center adjacent to the station will make it difficult to get into and out of the station during the

evening commute hour. Congestion would be most acute at the Foothill Road/I-580 interchange, on Foothill Road proper, and on Stoneridge Drive west of I-680.

East of Station D, BART turns south, proceeds at grade along the west side of I-680 on an extension of the freeway embankment partially within the I-680 right of way to Arroyo Valle where it crosses I-680 on aerial structure, and follows Bernal Avenue south of the Alameda County Fairgrounds. Since there are no existing crossings or interchanges on this segment of I-680, BART could conceivably be placed either at grade in the median or on aerial structure along the west side of the freeway within the existing right of way. The proposed interchange at W. Las Positas Boulevard could be constructed with provision for accommodating BART.

East of the Fairgrounds the line continues on aerial structure across the W.P. tracks, turns into the S.P. right of way along the west side of the mainline track and continues north to Pleasanton Station I (4,100 passengers; 1,980 parking spaces; 20 acres or 11 acres double decked) between Spring Street and Stanley Boulevard.

Access to Station I would be provided by Ray Street, Vineyard Avenue, Spring Street, and First Street. First Street, expected to experience moderate congestion by 1990, will provide good access to the station for south Pleasanton. Vineyard Avenue will provide direct access to the station for the area east of First Street. Main Street between Stanley Boulevard and Spring Street is expected to be used heavily by 1990, delaying patrons heading to this station.

Hopyard Road/ Division Street/ St. Mary's Street/ Spring Street provide the only present access route for the area north of the Fairgrounds, west of Hopyard Road. These streets, except Hopyard Road, are narrow and discontinuous. Construction of the Del Valle Parkway north of Arroyo Valle as proposed by the Pleasanton General Plan would alleviate this problem. If the S.P. tracks are not relocated to the W.P. right of way, access to Station I will be severely handicapped. The scarcity of land and the intensity of development around this station will make modifications to the street system adjacent to the station difficult.

From Station I, the line then continues along the S.P. tracks to the Radum Wye and crosses over the San Ramon branch line. From this point BART proceeds east along the north side of the W.P. tracks for approximately 4.5 miles to the first Livermore Station M (1,600 passengers; 770 parking spaces; 9 acres) between "L" Street and Livermore Avenue.

Between Pleasanton and Livermore, BART would be at grade except at sidings to the gravel pits north of Stanley Boulevard where BART would be on aerial structure. Through central Livermore, BART could either be at grade except for underpasses at Murietta Boulevard, "P" and "L" Streets, Livermore Avenue, and First Street, or on aerial structure.

Station M, located in the heart of downtown Livermore, would be served by three arterials, Railroad Avenue, "L" Street, and Livermore Avenue. The central location of this site and the fact that a number of major roads converge on the point, make this station equally accessible to all parts of the city. Access can be provided at three locations thus decreasing congestion at the station entrance. By 1990 Livermore Avenue, "L" Street and First Street will, in the station vicinity, experience a significant amount of congestion. The scarcity of open land will make provision of adequate parking at this site very disruptive.

Vehicular underpasses at "P" Street and Livermore Avenue are planned to be constructed as part of the first phase of the railroad consolidation project, currently in the final design stage, if the proposed formation of an assessment district is successful. It is anticipated that the Division of Highways will construct an overhead at East First Street (State Route 84) within the near future. Furthermore, it is anticipated that the proposed underpass at Murietta Boulevard will be constructed as part of the second phase of the railroad consolidation project prior to the BART extension. Therefore, it is assumed that at the above streets, it would be necessary only to construct parallel structures to accommodate BART. However, at "L" Street and Junction Avenue, it would be necessary to depress the streets and build structures for the S.P. and W.P. railroad tracks and BART.

From Station M the line continues 1.5 miles along the north side of the W.P. tracks to the second Livermore Station O (1,600 passengers; 770 parking spaces; 9 acres) between Trevarno Road and Arroyo Secco. A possible extension is north to Station P at the new community site.

RED LINE (Dublin Canyon - North Valley)

From Bay Fair Station through Dublin Canyon, the Red Line (22.3 miles) is the same as the Blue Line. At the western end of the Valley the Red Line leaves the median of I-580 east of Foothill Road under the westbound roadway, proceeds north eastward at grade, passes under I-680, and gradually

risers to an elevated Dublin Station B (2,700 passengers; 1,300 parking spaces; 14 acres) located on Dublin Boulevard between Sierra Court and Dougherty Road in Dublin.

Access from San Ramon is indirect via Old Ranch Road, Amador Valley Boulevard or Dublin Boulevard to Dougherty Road. Lacking is a through north-south arterial in the vicinity of the S.P. tracks. The Alcosta Boulevard interchange on I-680 is too far north to be of use for trips from San Ramon. San Ramon Valley Boulevard and Village Parkway must provide north-south access to Dublin Boulevard. There is excellent access via Dougherty Road interchange for trips using either the I-680 or I-580 freeway. Access is good for north Pleasanton via Hopyard Road/Dougherty Road.

East of Station B, the Red Line turns southeastward, returns to grade, passes beneath I-580 adjacent to the S.P. tracks, and proceeds on aerial structure within the existing right of way to the Pleasanton Station F (4,100 passengers; 1,980 parking spaces; 20 acres) located north of the proposed extension of Las Positas Boulevard. Las Positas Boulevard is the east-west access road to this station. Access from central Pleasanton is via Santa Rita Road. Neither Santa Rita Road nor Las Positas Boulevard between El Charro Road and Hopyard Road are expected to experience significant congestion by 1990. The proximity of the railroad tracks to the station would make provision of good access and circulation more difficult.

Immediately south of Station F, BART turns eastward on aerial structure, crosses over the S.P. tracks and Santa Rita Road, and follows the Arroyo Mocho on aerial structure for one-quarter mile east of Santa Rita Road. It then descends to grade, continues along the Arroyo Mocho, crosses over El Charro Road, and proceeds east along the south side of the proposed extension of Las Positas Boulevard.

Near the southeast corner of Livermore Airport, the line curves north of the Livermore Water Reclamation Plant over Kitty Hawk Road, and proceeds at grade just beyond the residential area in the northwest corner of Livermore, passes through the northern part of the trailer park near the I-580/Portola Avenue interchange on aerial structure, crosses over Portola Avenue, and proceeds southeast on aerial structure along the north side of Portola Avenue to the first Livermore Station K (1,600 passengers; 770 parking spaces; 9 acres) located in a shallow abandoned gravel pit east of Murietta Boulevard and Portola Avenue.

Access to Station K will be provided by four arterials, Portola Avenue, Murrieta Boulevard, North "P" Street, and Rincon Avenue. Of these, only Portola Avenue is expected to experience significant congestion by 1990. All of Livermore north of the railroad tracks would have direct access to this station. South Livermore, west of South "L" Street has direct access to the station via Murrieta Boulevard or "P" Street, avoiding the congestion of downtown Livermore. East and Southeast Livermore must depend on Livermore Avenue through downtown Livermore to reach the station via Portola Avenue. Livermore Avenue is expected to be severely overloaded by 1990 as is the section of First Street between Livermore Avenue and "L" Street.

From Station K, the Red Line continues largely on aerial structure along the north side of Portola Avenue to First Street (State Route 84). A row of new single-family homes along the south side of Briarwood Drive would have to be taken out.

After crossing over First Street, the line goes east to the W.P. mainline tracks, turns northeast and continues on the north side of the W.P. track on aerial structure to the second Livermore Station O (1,600 passengers; 770 parking spaces; 9 acres) located between Trevarno Road and Arroyo Secco in eastern Livermore. This station would be located adjacent to the railroad tracks and the northward extension of Mines Road across East Avenue. The Livermore General Plan calls for extending Mines Road north across the railroad tracks to First Street. Without this road there would be no access to the station. The line could be extended north to Station P at the new community site.

GREEN LINE (Dublin Canyon - North Valley - Downtown Livermore)

The Green Line (22.4 miles) is identical to the Blue Line from the Bay Fair Station through Dublin Canyon. West of Foothill Road in the Valley the line leaves I-580, heads southeast on aerial structure across Foothill Road to the north side of Stoneridge Drive. Here the line turns east, crosses I-680 on aerial structure to the Dublin Station E (2,700 passengers; 1,300 parking spaces; 14 acres) on the north side of Stoneridge Drive west of Hopyard Road.

Access to this station is provided by Hopyard Road and Stoneridge Drive. Trips from the north will arrive via I-680, I-580, or Dougherty Road and then Hopyard Road. Trips from areas east and southwest of the station will take Las Positas Boulevard to Hopyard Road. Areas west of the station will use the new Stoneridge Drive overcrossing of I-680. A Stoneridge Drive interchange with I-680 would improve access.

East of Station E, BART crosses over Hopyard Road and the Chabot Canal, continues eastward at grade to the S.P. San Ramon branch line, turns south-east on aerial structure to run along the west side of the S.P. right of way between Tassajara Creek and Las Positas Boulevard. Then the line turns east on aerial structure, crosses over the S.P. track and Santa Rita Road, and follows the Arroyo Mocho on aerial structure to the Pleasanton Station G (4,100 passengers; 2,000 parking spaces; 20 acres) located one-quarter mile east of Santa Rita Road.

This station would be served by a major arterial, Santa Rita Road. Las Positas Boulevard provides secondary access to this station. Neither Santa Rita Road nor Las Positas Boulevard between El Charro Road and Hopyard Road are expected to experience significant congestion by 1990.

East of Station G, BART descends to grade, runs along the Arroyo Mocho, crosses over El Charro Road, and proceeds at grade along the proposed extension of Las Positas Boulevard. Near the southwest corner of Livermore Airport, the BART alignment turns southeast and continues at grade to the north side of the W.P. mainline tracks approximately one-half mile west of Murietta Boulevard in Livermore. The first Livermore Station L (1,600 passengers; 770 parking spaces; 9 acres) is located just east of Murietta Boulevard on the north side of the W.P. tracks.

Access to Station L would be provided via Murrieta Boulevard and Stanley Boulevard. North Livermore would use Murrieta Boulevard while southwest Livermore would use Murrieta Boulevard or Stanley Boulevard. Only Stanley Boulevard, west of Murrieta Boulevard, is expected to experience significant congestion by 1990. Congestion at the station can be minimized by providing two separate points of access. The central station location significantly shortens the average trip length to the station. The line continues on the north side of the tracks to the second Livermore Station O, described for the Blue Line.

YELLOW LINE (San Ramon - North Valley)

Five possible alternate routes through Walnut Creek have not been fully evaluated. All San Ramon corridor lines assume the route north of Rudgear Road rated least disruptive in the preliminary evaluation phase. The Yellow Line (26.6 miles) begins at the Concord line in the median of State Highway 24 near El Curtola Boulevard and parallels I-680 to Rudgear Road then follows the S.P. tracks south to Dublin. There would be three Stations in the San Ramon Valley: South Walnut Creek (West), Danville (North), and San Ramon.

The South Walnut Creek (West) aerial station (700 parking spaces; 8.5 acres) would be located on the southeast side of the S.P. tracks and directly west of Danville Boulevard. All access would be provided by Danville Boulevard. Should Tice Valley Boulevard be extended east to Danville Boulevard, as shown on the Walnut Creek General Plan, then a second access point into the station would be provided.

To handle future traffic volumes at the intersection of Rudgear Road, Danville Boulevard and the I-680 ramps, substantial modifications will be necessary. The southbound I-680 on-ramp must be moved south, tying it into Danville Boulevard. Access to the proposed BART station should be provided opposite the new location of the on-ramp. With this change, Tice Valley Boulevard could then be extended to Danville Road, opposite Rudgear Road.

Between Rudgear Road and San Ramon Valley Boulevard, the S.P. is crossed by local streets at approximately one-quarter mile intervals. Sixty per cent of the S.P. right of way in this segment is 50 feet wide; the remainder is 100 feet wide. Because of the frequent street crossings and the narrow right of way, BART must be entirely on aerial structure. Whenever the S.P. right of way is 50 feet, it is very likely that additional right of way must be acquired to accommodate BART. If the S.P. has plans to double-track the San Ramon branch line, the Yellow Line would be jeopardized.

The Danville (North) station (700 parking spaces; 8.5 acres) would be on aerial structure located on the vacant parcel located east of the S.P. tracks between Linda Mesa Avenue and Prospect Avenue. The parcel is about 600 by 300 feet or 4.5 acres. To accommodate the required 700 parking spaces either the vacant parcel must be enlarged to 8.5 acres by acquisition of adjacent commercial development or it will be necessary to provide double deck parking. Access would be via Linda Mesa Avenue and Prospect Avenue, both two lane streets that intersect Hartz Avenue. Hartz Avenue is a 4-lane facility with parking that is expected to carry about 23,000 vehicles per day in 1990. The vast majority of the station users would use Hartz Avenue. People from the areas west of the S.P. tracks would cross the tracks at one of the numerous local crossings to Danville Boulevard/Hartz Avenue. Patrons coming from the freeway or the areas east of I-680 would reach Danville Boulevard/Hartz Avenue via La Gonda Way, Diablo Street or Sycamore Valley Road. Everyone would make a turn off Hartz Avenue to reach the station. To handle the anticipated station traffic volumes major improvements would be needed to increase the capacity of Linda Mesa Avenue and Prospect Avenue between the tracks and Hartz Avenue. Improvements at the intersection of Hartz Avenue with Linda Mesa Avenue, with Diablo Street and with Prospect Avenue also would be required.

From San Ramon Valley Road in Danville to Sycamore Valley Road in San Ramon, the Yellow Line would be at grade within the 100 foot S.P. right of way except for overpasses at I-680 and Sycamore Valley Road.

The San Ramon aerial station (780 parking spaces; 9 acres) would be located just south of Crow Canyon Road, west of the S.P. tracks. Primary access would be provided via Crow Canyon Road and Norris Canyon Road. Both roads cross I-680, thereby providing good access to the station for areas west of the freeway. Crow Canyon Road is the only street that will cross the S.P. tracks in the vicinity of the station. According to the General Plan for the area the next crossings will be approximately two miles to the north and two miles to the south. The General Plan also shows a future north-south road located 1,000 feet west of the S.P. tracks connecting the future Bollinger Canyon Road with Crow Canyon Road. This road will serve as the third important access point to the station, serving the two square mile area located between I-680, the S.P. tracks, Crow Canyon Road and Bollinger Canyon Road. To provide better access for the areas northeast of the station it is important that Norris Canyon Road be extended across the S.P. tracks to the northern extension of Alcosta Boulevard. 1990 Division of Highways projections show 28,000 to 36,000 vehicles per day on Crow Canyon Road and 4,000 to 5,000 vehicles per day on the other two roads serving the station. Alcosta Boulevard is expected to carry less than 4,000 vehicles per day. Assuming the above improvements, access to this station will be excellent. Acquisition of the station site would not be too disruptive.

For the first 2 miles south of Crow Canyon Road the Yellow Line would be on aerial structure through industrial zoned land to allow the S.P. to build spur tracks to serve new shippers. South of this section the line would be at grade to Alamo Creek in Dublin. Grade separations for major streets would be constructed to provide circulation across the tracks. South of Alamo Creek BART continues on aerial structure to Dublin Station A.

Dublin Station A (1,300 passengers; 640 parking spaces; 8 acres) is located on the west side of the S.P. tracks just south of Dougherty Road. Access from San Ramon is indirect via Old Ranch Road, Amador Valley Boulevard or Dublin Boulevard to Dougherty Road. The Alcosta Boulevard interchange on I-680 is too far north to be of use for trips from San Ramon, but the Dougherty Road interchange is close for trips on either I-680 or I-580. There is also good access for north Pleasanton via Hopyard Road to Dougherty Road. San Ramon Valley Boulevard and Village Parkway will provide north-south access to Dublin and Amador Valley Boulevards. The location of the station adjoining the railroad will complicate the access pattern.

South of Dublin the line continues along the west side of the tracks, crosses under I-580, and proceeds on aerial structure to a point north of Las Positas Boulevard in Pleasanton. Here the line turns east on aerial structure, crosses over the S.P. tracks and Santa Rita Road, and follows the Arroyo Mocho on aerial structure to the Pleasanton Station G (3,900 passengers; 1,880 parking spaces; 19 acres) located one-quarter mile east of Santa Rita Road.

This station would be served by a major arterial, Santa Rita Road. Las Positas Boulevard provides secondary access to this station. Neither Santa Rita Road nor Las Positas Boulevard between El Charro Road and Hopyard Road are expected to experience significant congestion by 1990.

East of Station G, this route descends to grade, and is identical to the Red Line. Livermore stations are Station K and Station O.

ORANGE LINE (San Ramon - South Valley)

In the San Ramon corridor the alignment of the Orange Line (29.6 miles) is the same as the Yellow Line, along the S.P. tracks. However, the San Ramon Valley Stations are located at Alamo, Danville (North), and San Ramon.

The Alamo aerial station (700 parking spaces; 8.5 acres) would be located in the vacant land east of the S.P. tracks and south of Alamo Way. Sole access would be a station access road connecting to Danville Boulevard opposite Jackson Way. Transit users coming from I-680 and areas east of I-680 would use Stone Valley Road and then Danville Boulevard to get to the station. Congestion would occur at the intersection of the station access road and Danville Boulevard which is projected to carry 20,000 vehicles per day by 1990. This figure assumes construction of the Route 93 freeway from I-680 west to Route 77, a highly unlikely prospect. Therefore, it can be expected that some of the 50,000 vehicles per day that were to be on Route 93 will be using Danville Boulevard and the remainder will use I-680. This means Danville Boulevard will be operating near capacity by 1990.

The Danville (North) station is the same as previously described for the Yellow Line.

South of Danville this line is identical to the Yellow Line until it leaves the right of way of the S.P. San Ramon branch line between the Alamo Canal and Dougherty Road in Dublin and proceeds south on an aerial structure to the Dublin Station B (discussed under Red Line) situated immediately north of Dublin Boulevard and west of Dougherty Road. From this Station, the line

continues south on aerial structure over Dublin Boulevard and I-580, and then turns slightly southwest crossing over the Alamo Canal north of the Valley Community Services District Sewage Treatment Plant south of Stoneridge Drive.

South of Stoneridge Drive, the Orange Line proceeds along the embankment between I-680 and the Alamo Canal, crosses over the Arroyo Valle, and turns east on an aerial structure to follow Bernal Avenue to the Pleasanton Station J (3,900 passengers; 1,880 parking spaces; 19 acres) situated immediately south of Bernal Avenue near the Alameda County Fairgrounds.

This Station depends on Bernal Avenue for its access. Transit patrons from east Pleasanton would have direct access via the planned Bernal Avenue extension. The triangle bordered by Bernal Avenue, I-680 and Sunol Boulevard would have direct, uncongested access via a roadway network that will be constructed as the land south of the station develops. North Pleasanton will find direct access to the station blocked by the County Fairgrounds. People from that area must either head through downtown Pleasanton, putting undue pressure on such streets as Division Street, Pleasant Avenue, and Main Street, and the older residential area west of downtown or head around the west end of the Fairgrounds via the Valley Avenue Extension. It is anticipated that most people located north of the Arroyo Valle would prefer to travel north to a Dublin Station. During events at the Fairgrounds, this station would decrease congestion on Bernal Avenue by reducing the number of automobile trips to the Fairgrounds.

Between Stoneridge Drive and Bernal Avenue along I-680, the area available for BART may be insufficient to accommodate at-grade construction. In that case, BART would be carried on an aerial structure. East of Station J, the route continues on aerial structure across the W.P. mainline track, and is identical to the Blue Line.

BROWN LINE (San Ramon - South Valley)

From Walnut Creek to the Dublin Station A the Brown Line (27.3 miles) follows I-680 to Danville and then continues south in the S.P. right of way. Five possible alternate routes through Walnut Creek north of Rudgear Road have not been fully evaluated. Stations in the San Ramon Valley are South Walnut Creek (East), Danville (South), and San Ramon.

The South Walnut Creek (East) station (700 spaces parking; 8.5 acres) will be located between I-680 and San Ramon Creek north of Brookdale Avenue. The

station platform would be located either in the freeway median or west of the freeway. The exact location is subject to further study. The area that would be needed for parking is occupied by about 12 homes and is isolated from the community by the freeway on the north and east, San Ramon Creek on the west and a large knoll on the south. A narrow bridge connecting the area to Danville Boulevard would have to be replaced by a 4 lane connection and access would be concentrated at this point. Danville Boulevard is anticipated to carry about 22,000 vehicles per day by 1990, and volumes could be 10,000 to 20,000 vehicles per day higher if the Route 93 freeway connecting Alamo to Moraga is not built. To lessen the congestion that is expected on Danville Boulevard at the intersection with the station access road, it might be possible to split the access roads, one for inbound and one for out bound traffic.

From Rudgear Road in Walnut Creek to Diablo Road in Danville this route follows the alignment of I-680. After leaving the freeway right of way at Diablo Road, this route proceeds southward on aerial structure and enters the S.P. right of way near Sycamore Valley Road.

The section of I-680 between Rudgear Road and Sycamore Valley Road was designed to provide initially 4 lanes and a 46-foot median with provisions for the future addition of 2 lanes in the median. The Division of Highways is currently preparing to widen this segment to 6 lanes by adding an additional lane on the outside of each roadway. If required in the future, an additional two lanes could be constructed within the existing 46-foot median, although the resulting 22-foot median width would be less than the current desirable minimum of 30 feet.

Several concepts for accommodating BART within the freeway have been explored. Since all of the grade separations along this section except Sycamore Valley Road are underpasses, the freeway could be widened to the outside, either to accommodate additional freeway lanes or BART, with a minimum of disruption to the existing structures. However, no widening beyond that required to provide 6 lanes could be accomplished entirely within the existing freeway right of way, particularly in areas where the existing ground is steeply sloped near the right of way line. In many areas, residential development abuts the right of way line.

BART could not be placed at grade in the existing 46-foot median without widening the freeway since the resulting 3 foot horizontal clearance from the edge of the traveled way to the required 40-foot BART right of way would

obviously be inadequate. Therefore, placing BART at grade in the median would require widening the freeway from 34 to 58 feet, depending upon whether an allowance is made for future widening from 6 to 8 lanes by adding two lanes in the median. Because of the extensive reconstruction and additional right of way required to implement this concept, it was tentatively abandoned.

The concept of placing BART on aerial structure in the existing 46-foot median without widening the freeway was then investigated. The resulting 17 foot horizontal clearance from the edge of the existing roadway to the face of the crash barrier protecting the columns supporting the aerial structure would probably be adequate initially. However, it would not permit the Division of Highways to widen the freeway from 6 to 8 lanes by adding the additional two lanes in the median, since the resulting horizontal clearance of only 5 feet would be totally unacceptable. Therefore, it is presently assumed that BART could be placed on aerial structure in the median. Other possibilities include placing BART on aerial structure on the side slopes adjacent to the freeway, or on cut or fill with retaining walls adjacent to the freeway.

The Danville (South) station (700 parking spaces; 8.5 acres) would be on aerial structure located between Laurel Drive and Sycamore Valley Road just east of the S.P. tracks. About 20 single family homes would have to be acquired. Access would be by Laurel Drive to the north and Sycamore Valley Road to the south. Sycamore interchanges with I-680 and Laurel crosses the freeway, providing access from the west. Brookside Drive, east of the station, would serve as the connector between Laurel Drive and Sycamore Valley Road. Both Laurel Drive and Brookside Drive are 2-lane local roads. Sycamore Valley Road is a major arterial with two lanes at present but planned for expansion to 4 lanes divided in the future. 1990 projections show Sycamore Valley Road carrying about 12,000 vehicles per day or about half of the street's traffic carrying capacity.

Primary access to the station would be concentrated on Sycamore Valley Road. Because of this it can be expected that congestion will occur at the intersections of Sycamore Valley Road with San Ramon Valley Boulevard, with I-680, and at the station access road.

Between Danville and I-580 this line is identical to the Yellow Line. From I-580 it proceeds on aerial structure along the S.P. tracks to the Pleasanton Station H (3,900 passengers; 1,900 parking spaces; 19 acres) located between Kaiser Road and Stanley Boulevard. Station H depends on a single roadway to provide access - Valley Avenue.

Most trips arriving at this station will have origins west or south of the station. Trips from the west can reach Valley Avenue either via Hopyard Road or via Santa Rita Road. The weak point of this access road is the 100-200 foot offset of Valley Avenue at the intersection with Santa Rita Road. This will be eliminated to avoid a severe capacity bottleneck. All trips from the south and southwest must travel through downtown Pleasanton via such streets as Main, Ray and Spring.

When Valley Avenue is extended south across Stanley Boulevard and Pico Avenue is extended north across the Arroyo Valle to the intersection of Stanley Boulevard and the Valley Avenue Extension, access to the Station H can be provided from two directions, splitting the traffic load, reducing the congestion at the intersection of Santa Rita Road and Valley Avenue, reducing the travel time and distance for trips with origins south of Stanley Boulevard, and decreasing the number of trips through downtown Pleasanton.

Where the Valley Avenue will extend across Stanley Boulevard, the proximity of the S.P. and W.P. tracks and the S.P. branch line intersection will make it difficult to construct an efficient interchange.

South of Station H, the Brown Line turns east and crosses the S.P. tracks at the Radum Wye. From this point, the line proceeds to Livermore along the north side of the W.P. tracks to Murrieta Boulevard and Stations L and O in the same way as the Green Line.

APPENDIX B: BLUE LINE EVALUATION (Dublin Canyon Corridor 23.5 Miles)

Judgment measures on an ordinal scale:

A-100% or exceptional; B-excellent; C-good, better than--; D-average, workable, acceptable; E-fair, less than--; F-poor; G-none.

	Scale; Unit of Measurement	Total Summary	Castro Valley Station		Dublin Station		Pleasanton Station		Livermore Station		Livermore Station	
			Link	CV	Link	D	Link	I	Link	M	Link	O
1. Objective: Minimize BART Construction and Operating Costs	Ratio; million \$	186										
b. Total capital cost												
2. Objective: Maximize BART Usage												
a. Population potential within 1,500 ft. of stations	Ratio; persons	21,560		4,200		2,660		4,000		3,200		7,500
b. Population 1980 within 1 mile service area from stations	Ratio; persons	107,400		52,300 ^a		7,300		15,900		20,700		11,200
c. Population potential within 1 mile service area from stations in addition to Criterion b.	Ratio; persons	25,100		11,100 ^b		4,500		2,800		3,500		3,200
d. Accessibility of stations to 1980 population within 8 min. driving time	Ratio; index = population ÷ driving time to station	55		n.a.		39		59		100		20
e. Existing and potential employment within 1,500 feet of stations	Ratio; persons	3,620		300		0		800		2,500		20
f. RTTPP patronage projections, 1980 (1990)	Ratio; persons	(13,100)		(500)		(4,000)		(1,600)		(5,000)		(2,000)
g. Average Valley travel time for BART patrons	Ratio; work trips	20,701										
h. Suitability to serve young, old, poor, and disabled	Ratio; minutes	11.17										
	Ordinal			E		G		D		D		F
4. Objective: Avoid Change in Developed Residential Neighborhoods												
a. Proximity of stations to existing development	Interval; index increases with distance	14		0		10		23		0		38
b. Propensity for change in neighborhoods near BART stations	Interval; index decreases with acreage subject to change	58		0		63		61		70		98
c. Line disruption	Interval; index decreases with lineal ft. of impact	79		90		97		70		59		78
d. Traffic disruption	Ordinal			C		B		E		F		C
e. Station disruption	Ordinal			D		D		E		D		D
	Ratio; acres acquired	35		10		0		18		7		0

Scale; Unit of Measurement	Total Summary	Link	Castro Valley Station CV	Link	Dublin Station D	Link	Pleasanton Station I	Link	Livermore Station M	Link	Livermore Station O
5. Objective: Maximize Environmental Compatibility											
a. Noise levels	Ordinal; rank based on lineal feet	B	B	B	B	C	B	C	B	B	B
b. Visual and physical fit	Ordinal	D	C	D	C	D	B	B	D	E	F
c. Urban design potential	Ordinal		B		C		C		C		F
6. Objective: Minimize Inequities Created by a BART Extension											
a. Displacement by stations or routes	Ordinal	B	D	A	A	C	F	G	F	C	A
7. Objective: Preserve Maximum Open Space											
a. Population potential within 1,500 ft. of stations	Ratio; persons	21,560	4,200		2,660		4,000		3,200		7,500
b. Population potential within 1 mile service area from stations	Ratio; persons	132,500	63,400 ^b		11,800		18,700		24,200		14,400
11. Objective: Maximize Economic Development at Point of Connection to Existing BART Line											
a. Net change in jobs projected in 1990 within 1 mile of extension terminal	Ordinal	E									
b. Net change in RTTPP projected attractions with an extension	Ratio/trips	+313									
c. Development potential near extension terminal	Ordinal	E									
13. Objective: Maximize Compatibility with Existing General Plans											
a. Degree of conflict with existing general plans	Ordinal	E			D		D		D		D
14. Objective: Maximize Compatibility with Existing BART System and with Other Potential Transit Extensions											
a. Available capacity on existing line	Ordinal	C									
b. Compatibility with transfers to a bus system	Ordinal	D									
c. Compatibility with transfers to a rail system	Ordinal	D									

APPENDIX B: RED LINE EVALUATION (Dublin Canyon Corridor 22.3 Miles)

Judgment measures on an ordinal scale:
A-100% or exceptional; B-excellent; C-good, better than--; D-average, workable, acceptable; E-fair, less than--; F-poor; G-none.

Scale; Unit of Measurement	Total Summary	Castro Valley Station CV	Dublin Station B	Pleasanton Station F	Livermore Station K	Livermore Station O
1. Objective: Minimize BART Construction and Operating Costs	172					
b. Total capital cost	Ratio; million \$					
2. Objective: Maximize BART Usage						
a. Population potential within 1,500 ft. of stations	Ratio; persons	21,730	4,200	0	4,680	5,350
b. Population 1980 within 1 mile service area from stations	Ratio; persons	94,900	52,300 ^a	8,600	8,400	14,400
c. Population potential within 1 mile service area from stations in addition to Criterion b.	Ratio; persons	29,100	11,100 ^b	1,200	2,800	10,800
d. Accessibility of stations to 1980 population within 8 min. driving time	Ratio; index = population ÷ driving time to station	45	n.a.	53	24	85
e. Existing and potential employment within 1,500 feet of stations	Ratio; persons	550	300	200	0	30
f. RTTPP patronage projections, 1980	Ratio; persons	(4,800)	(500)	(400)	(1,800)	(2,000)
g. Average Valley travel time for BART patrons	Ratio; work trips	20,701				
h. Suitability to serve young, old, poor, and disabled	Ratio; minutes	10.49				
Ordinal		E	F	G	E	F
4. Objective: Avoid Change in Developed Residential Neighborhoods						
a. Proximity of stations to existing development	Interval; index increases with distance	17	0	29	14	6
b. Propensity for change in neighborhoods near BART stations	Interval; index decreases with acreage subject to change	63	0	100	95	22
c. Line disruption	Interval; index decreases with lineal ft. of impact	91	90	97	93	89
d. Traffic disruption	Ordinal		C	B	A	B
e. Station disruption	Ordinal		D	B	C	B
	Ratio; acres acquired	11	10	0	0	1

	Scale; Unit of Measurement	Total Summary	Castro Valley Station CV	Dublin Station B	Pleasanton Station F	Livermore Station K	Livermore Station O
			Link	Link	Link	Link	Link
5. Objective: Maximize Environmental Compatibility							
a. Noise levels	Ordinal; rank based on lineal feet		B	A	A	D	C
b. Visual and physical fit	Ordinal		D	D	E	C	D
c. Urban design potential	Ordinal		B	D	C	E	F
6. Objective: Minimize Inequities Created by a BART Extension							
a. Displacement by stations or routes	Ordinal		B	D	A	A	B
7. Objective: Preserve Maximum Open Space							
a. Population potential within 1,500 ft. of stations	Ratio; persons	21,730	4,200	0	4,680	5,350	7,500
b. Population potential within 1 mile service area from stations	Ratio; persons		63,400 ^b	9,800	11,200	25,200	14,400
11. Objective: Maximize Economic Development at Point of Connection to Existing BART Line							
a. Net change in jobs projected in 1990 within 1 mile of extension terminal	Ordinal	E					
b. Net change in RTTPP projected attractions with an extension	Ratio/trips	+313					
c. Development potential near extension terminal	Ordinal	E					
13. Objective: Maximize Compatibility with Existing General Plans							
a. Degree of conflict with existing general plans	Ordinal		E	D	D	D	D
14. Objective: Maximize Compatibility with Existing BART System and with Other Potential Transit Extensions							
a. Available capacity on existing line	Ordinal	C					
b. Compatibility with transfers to a bus system	Ordinal	A					
c. Compatibility with transfers to a rail system	Ordinal	D					

APPENDIX B: GREEN LINE EVALUATION (Dublin Canyon Corridor 22.4 Miles)

Judgment measures on an ordinal scale:
A-100% or exceptional; B-excellent; C-good, better than--; D-average, workable, acceptable; E-fair, less than--; F-poor; G-none.

	Scale; Unit of Measurement	Summary	Link	CV	Link	E	Link	G	Link	L	Link	O
1. Objective: Minimize BART Construction and Operating Costs	Ratio; million \$	165										
b. Total capital cost												
2. Objective: Maximize BART Usage												
a. Population potential within 1,500 ft. of stations	Ratio; persons	26,900		4,200		5,400		5,700		4,100		7,500
b. Population 1980 within 1 mile service area from stations	Ratio; persons	107,000		52,300 ^a		8,400		11,400		23,700		11,200
c. Population potential within 1 mile service area from stations in addition to Criterion b.	Ratio; persons	18,000		11,100 ^b		900		2,100		700		3,200
d. Accessibility of stations to 1980 population within 8 min. driving time	Ratio; index = population ÷ driving time to station	53		n.a.		69		40		93		20
e. Existing and potential employment within 1,500 feet of stations	1972 Ratio; persons (1990) Ratio; persons	1,125 (5,050)		300 (500)		0 (900)		5 (50)		800 (1,600)		20 (2,000)
f. RTTP patronage projections, 1980	Ratio; work trips	20,701										
g. Average Valley travel time for BART patrons	Ratio; minutes	10.23										
h. Suitability to serve young, old, poor, and disabled	Ordinal			E		G		G		D		F
4. Objective: Avoid Change in Developed Residential Neighborhoods												
a. Proximity of stations to existing development	Interval; index increases with distance	11		0		14		4		0		38
b. Propensity for change in neighborhoods near BART stations	Interval; index decreases with acreage subject to change	51		0		80		20		56		98
c. Line disruption	Interval; index decreases with lineal ft. of impact	86		90		96		93		100		53
d. Traffic disruption	Ordinal			C		B		B		B		C
e. Station disruption	Ordinal			D		C		C		B		D
	Ratio; acres acquired	13		10		2		0		1		0

	Scale; Unit of Measurement	Total Summary	Castro Valley Station		Dublin Station		Pleasanton Station		Livermore Station		Livermore Station
			CV	Link	E	Link	G	Link	L	Link	
5. Objective: Maximize Environmental Compatibility											
a. Noise levels	Ordinal; rank based on lineal feet		B	C	B	B	B	B	B	B	
b. Visual and physical fit	Ordinal		D	D	D	C	C	D	D	E	E
c. Urban design potential	Ordinal		B	E	E	E	E	D	D	F	F
6. Objective: Minimize Inequities Created by a BART Extension											
a. Displacement by stations or routes	Ordinal		B	D	A	B	A	A	B	D	A
7. Objective: Preserve Maximum Open Space											
a. Population potential within 1,500 ft. of stations	Ratio; persons	26,900	4,200	5,400	5,700	4,100	7,500				7,500
b. Population potential within 1 mile service area from stations	Ratio; persons	125,000	63,400 ^b	9,300	13,500	24,400	14,400				14,400
11. Objective: Maximize Economic Development at Point of Connection to Existing BART Line											
a. Net change in jobs projected in 1990 within 1 mile of extension terminal	Ordinal	E									
b. Net change in RTTPP projected attractions with an extension	Ratio/trips	+313									
c. Development potential near extension terminal	Ordinal	E									
13. Objective: Maximize Compatibility with Existing General Plans											
a. Degree of conflict with existing general plans	Ordinal		E	E	D	E	D		E	D	D
14. Objective: Maximize Compatibility with Existing BART System and with Other Potential Transit Extensions											
a. Available capacity on existing line	Ordinal	C									
b. Compatibility with transfers to a bus system	Ordinal	C									
c. Compatibility with transfers to a rail system	Ordinal	B									

APPENDIX B: YELLOW LINE EVALUATION (San Ramon Corridor 26.6 Miles)

Judgment measures on an ordinal scale:

A-100% or exceptional; B-excellent; C-good, better than--; D-average, workable, acceptable; E-fair, less than--; F-poor; G-none.

1. Objective: Minimize BART Construction and Operating Costs

Scale; Unit of Measurement	Summary	Link	WC-W	Link	DN-N	Link	San Ramon Station SR	Link	Dublin Station A	Link	Pleasanton Station G	Link	Livermore Station K	Link	Livermore Station O
b. Total capital cost	Ratio; million \$	263													

2. Objective: Maximize BART Usage

a. Population potential within 1,500 ft. of stations from stations	Ratio; persons	27,975	4,000	4,000	500	925	5,700	5,350	7,500
b. Population 1980 within 1 mile service area	Ratio; persons	97,700	23,500 ^a	16,000 ^a	13,200 ^a	8,000	11,400	14,400	11,200
c. Population potential within 1 mile service area from stations in addition to Criterion b.	Ratio; persons	35,700	5,500 ^b	3,700 ^b	8,800 ^b	1,600	2,100	10,800	3,200
d. Accessibility of stations to 1980 population within 8 min. driving time	Ratio; index = population ÷ driving time to station	47	n.a.	n.a.	n.a.	44	40	85	20
e. Existing and potential employment within 1,500 feet of stations (1972 (1990))	Ratio; persons	755	0	400	200	100	5	30	20
f. RTTPP patronage projections, 1980	Ratio; persons	(5,150)	(0)	(800)	(2,000)	(200)	(50)	(100)	(200)
g. Average Valley travel time for BART patrons	Ratio; work trips	18,675							
h. Suitability to serve young, old, poor, and disabled	Ratio; minutes	10.43							
Ordinal	G	D	F	F	G	E	F		

4. Objective: Avoid Change in Developed Residential Neighborhoods

a. Proximity of stations to existing development	Interval; index increases with distance	23	0	0	100	14	4	6	38
b. Propensity for change in neighborhoods near BART stations	Interval; index decreases with acreage subject to change	43	0	3	66	92	20	22	98
c. Line disruption	Interval; index decreases with lineal ft. of impact	77	23	48	96	98	97	92	85
d. Traffic disruption	Ordinal		C	E	A	B	B	B	C
e. Station disruption	Ordinal		B	E	B	B	C	B	D
Ratio; acres acquired		13	6	6	0	0	0	1	0

Scale; Unit of Measurement	Total Summary	Walnut Creek West Station		Danville North Station		San Ramon Station		Dublin Station		Pleasanton Station		Livermore Station		
		Link	WC-W	Link	DN-N	Link	SR	Link	A	Link	G	Link	K	Link
5. Objective: Maximize Environmental Compatibility														
	a. Noise levels													
	b. Visual and physical fit													
c. Urban design potential														
6. Objective: Minimize Inequities Created by a BART Extension														
	a. Displacement by stations or routes													
7. Objective: Preserve Maximum Open Space														
	a. Population potential within 1,500 ft. of stations													
b. Population potential within 1 mile service area from stations														

5. Objective: Maximize Environmental Compatibility

a. Noise levels

b. Visual and physical fit

c. Urban design potential

6. Objective: Minimize Inequities Created by a BART Extension

a. Displacement by stations or routes

7. Objective: Preserve Maximum Open Space

a. Population potential within 1,500 ft. of stations

b. Population potential within 1 mile service area from stations

11. Objective: Maximize Economic Development

a. Point of Connection to Existing BART Line

a. Net change in jobs projected in 1990 within

1 mile of extension terminal

b. Net change in RTTPP projected attractions

with an extension

c. Development potential near extension terminal

13. Objective: Maximize Compatibility with Existing General Plans

a. Degree of conflict with existing general plans

14. Objective: Maximize Compatibility with Existing BART System and with Other Potential Transit Extensions

a. Available capacity on existing line

b. Compatibility with transfers to a bus system

c. Compatibility with transfers to a rail system

APPENDIX B: ORANGE LINE EVALUATION (San Ramon Corridor 29.6 Miles)

Judgment measures on an ordinal scale:

A-100% or exceptional; B-excellent; C-good, better than--; D-average, workable, acceptable; E-fair, less than--; F-poor; G-none.

1. Objective: Minimize BART Construction and Operating Costs

b. Total capital cost

Ratio; million \$ 296

2. Objective: Maximize BART Usage

a. Population potential within 1,500 ft. of stations

Ratio; persons 23,300

b. Population 1980 within 1 mile service area from stations

Ratio; persons 92,000

c. Population potential within 1 mile service area from stations in addition to Criterion b.

Ratio; persons 24,000

d. Accessibility of stations to 1980 population within 8 min. driving time

Ratio; index = population ÷ driving time to station 59

e. Existing and potential employment within 1,500 feet of stations

Ratio; persons 3,640
Ratio; persons (11,600)
Ratio; work trips 18,675

f. RTTPP patronage projections, 1980

Ratio; minutes 11.55

g. Average Valley travel time for BART patrons
h. Suitability to serve young, old, poor, and disabled

Ordinal

4. Objective: Avoid Change in Developed Residential Neighborhoods

a. Proximity of stations to existing development

Interval; index increases with distance 29

b. Propensity for change in neighborhoods near BART stations

Interval; index decreases with acreage subject to change 62

c. Line disruption

Interval; index decreases with lineal ft. of impact 67

d. Traffic disruption

Ordinal

e. Station disruption

Ratio; acres acquired 20

3722

Scale; Unit of Measurement	Total Summary	Link	Alamo Station A-L	Danville North Station DN-N	San Ramon Station SR	Dublin Station B	Pleasanton Station J	Livermore Station M	Livermore Station O
Ratio; million \$	296								
Ratio; persons	23,300	4,000	4,000	4,000	500	0	4,100	3,200	7,500
Ratio; persons	92,000	13,000 ^a	16,000 ^a	13,200 ^a	8,600	11,200	9,400	20,700	11,200
Ratio; persons	24,000	1,300 ^b	3,700 ^b	8,800 ^b	1,200	3,200	2,300	3,500	3,200
Ratio; index = population ÷ driving time to station	59	n. a.	n. a.	n. a.	53	63	20	100	20
Ratio; persons	3,640	300	400	200	200	20	(1,000)	2,500	20
Ratio; persons	(11,600)	(400)	(800)	(2,000)	(400)			(5,000)	(2,000)
Ratio; work trips	18,675								
Ratio; minutes	11.55								
Ordinal		G	D	F	F	D	D	D	F

Interval; index increases with distance	29	0	0	100	29	0	0	0	38
Interval; index decreases with acreage subject to change	62	0	3	66	100	97	70	98	
Interval; index decreases with lineal ft. of impact	67	0	69	96	96	32	78		
Ordinal		D	E	A	B	C	F	C	
Ordinal		D	E	B	B	C	D	D	
Ratio; acres acquired	20	6	6	0	0	1	7	0	

	Scale; Unit of Measurement	Total Summary	Alamo		Danville		San Ramon		Dublin		Pleasanton		Livermore		Livermore Station
			Link	Station AL	Link	Station DN-N	Link	Station SR	Link	Station B	Link	Station J	Link	Station M	Link
5. Objective: Maximize Environmental Compatibility															
a. Noise levels	Ordinal; rank based on lineal feet		E	D	D	D	D	D	G	D	A	D	D	B	
b. Visual and physical fit	Ordinal		D	E	E	D	D	D	C	D	D	D	E	D	E
c. Urban design potential	Ordinal			E	E	E		E		E	D	D	C	C	F
6. Objective: Minimize Inequities Created by a BART Extension															
a. Displacement by stations or routes	Ordinal		F	C	A	C	A	A	A	A	A	B	E	F	C
7. Objective: Preserve Maximum Open Space at Point of Connection to Existing BART Line															
a. Population potential within 1,500 ft. of stations	Ratio; persons	23,300		4,000		4,000		500		0		4,100		3,200	7,500
b. Population potential within 1 mile service area from stations	Ratio; persons	116,100		14,300 ^b		19,700 ^b		22,000 ^b		9,800		11,700		24,200	14,400
11. Objective: Maximize Economic Development															
a. Net change in jobs projected in 1990 within 1 mile of extension terminal	Ordinal	C													
b. Net change in RTTPP projected attractions with an extension	Ratio/trips	+74													
c. Development potential near extension terminal	Ordinal	C													
13. Objective: Maximize Compatibility with Existing General Plans															
a. Degree of conflict with existing general plans	Ordinal		E		E			D		D		D		D	E
14. Objective: Maximize Compatibility with Existing BART System and with Other Potential Transit Extensions															
a. Available capacity on existing line	Ordinal	E													
b. Compatibility with transfers to a bus system	Ordinal	B													
c. Compatibility with transfers to a rail system	Ordinal	D													

a. 1980 tributary population (approximately 2 1/4 miles).
b. 1990 tributary population (approximately 2 1/4 miles).

APPENDIX B: BROWN LINE EVALUATION (San Ramon Corridor 27.2 Miles)

Judgment measures on an ordinal scale:
A-100% or exceptional; B-excellent; C-good, better than--; D-average,
workable, acceptable; E-fair, less than--; F-poor; G-none.

24,025

Walnut Creek East Station

DN-S

San Ramon Station

Dublin Station

Pleasanton Station

Livermore Station

Livermore Station

Scale; Unit of Measurement	Link	WC-E	Link	DN-S	Link	SR	Link	A	Link	H	Link	L	Link	O
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Total Summary

273

1. Objective: Minimize BART Construction and Operating Costs
- b. Total capital cost

Ratio; million \$

273

2. Objective: Maximize BART Usage

a. Population potential within 1,500 ft. of stations	Ratio; persons	24,025	4,000	2,100	500	925	4,000	3,100	7,500
b. Population 1980 within 1 mile service area from stations	Ratio; persons	97,700	23,500 ^a	16,000 ^a	13,200 ^a	8,000	10,500	23,700	11,200
c. Population potential within 1 mile service area from stations in addition to Criterion b.	Ratio; persons	35,700	5,500 ^b	3,700 ^b	8,800 ^b	1,600	4,800	700	3,200
d. Accessibility of stations to 1980 population within 8 min. driving time	Ratio; index = population ÷ driving time to station	49	n.a.	n.a.	n.a.	44	39	93	20

- e. Existing and potential employment within 1,500 feet of stations

1972	Ratio; persons	1,190	0	20	200	100	50	800	20
(1990)	Ratio; persons	(6,820)	(0)	(20)	(2,000)	(200)	(1,000)	(1,000)	(2,000)

- f. RTTP patronage projections, 1980

Ratio; work trips

18,675

- g. Average Valley travel time for BART patrons

Ratio; minutes

10.63

- h. Suitability to serve young, old, poor, and disabled

Ordinal	G	G	G	F	F	F	D	F
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4. Objective: Avoid Change in Developed Residential Neighborhoods

a. Proximity of stations to existing development	Interval; index increases with distance	27	0	0	100	14	38	0	38
b. Propensity for change in neighborhoods near BART stations	Interval; index decreases with acreage subject to change	52	0	3	66	92	46	56	98
c. Line disruption	Interval; index decreases with lineal ft. of impact	74	23	48	96	98	100	100	53
d. Traffic disruption	Ordinal	D	D	C	A	B	C	B	C
e. Station disruption	Ordinal	D	D	C	B	B	D	B	D
	Ratio; acres acquired	13	6	6	0	0	0	0	0

Scale; Unit of Measurement	Total Summary	Walnut Creek East Station		Danville South Station		San Ramon Station		Dublin Station		Pleasanton Station		Livermore Station		Livermore Station	
		Link	WC-E	Link	DN-S	Link	SR	Link	A	Link	H	Link	L	Link	O

Ordinal; rank based on lineal feet

Ordinal

5. Objective: Maximize Environmental Compatibility

a. Noise levels

b. Visual and physical fit

c. Urban design potential

6. Objective: Minimize Inequities Created by a BART Extension

a. Displacement by stations or routes

Ordinal

7. Objective: Preserve Maximum Open Space

a. Population potential within 1,500 ft. of stations

b. Population potential within 1 mile service area from stations

Ratio; persons

Ratio; persons

11. Objective: Maximize Economic Development at Point of Connection to Existing BART Line

a. Net change in jobs projected in 1990 within 1 mile of extension terminal

b. Net change in RTTPP projected attractions with an extension

c. Development potential near extension terminal

Ordinal

Ratio/trips

Ordinal

13. Objective: Maximize Compatibility with Existing General Plans

a. Degree of conflict with existing general plans

14. Objective: Maximize Compatibility with Existing BART System and with Other Potential Transit Extensions

a. Available capacity on existing line

b. Compatibility with transfers to a bus system

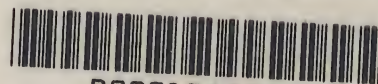
c. Compatibility with transfers to a rail system

Ordinal

Ordinal

Ordinal

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